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- 333-MHz Celeron PCs
- REX PRO
- MS Money 99
- Norton AntiVirus 5.0
- WinFax Pro 9.0
- CE and Pilot Software

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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOL. 17 NO. 18 OCTOBER 20, 1998

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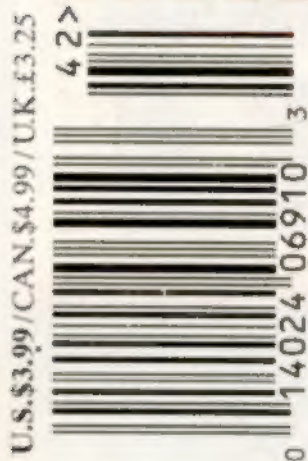
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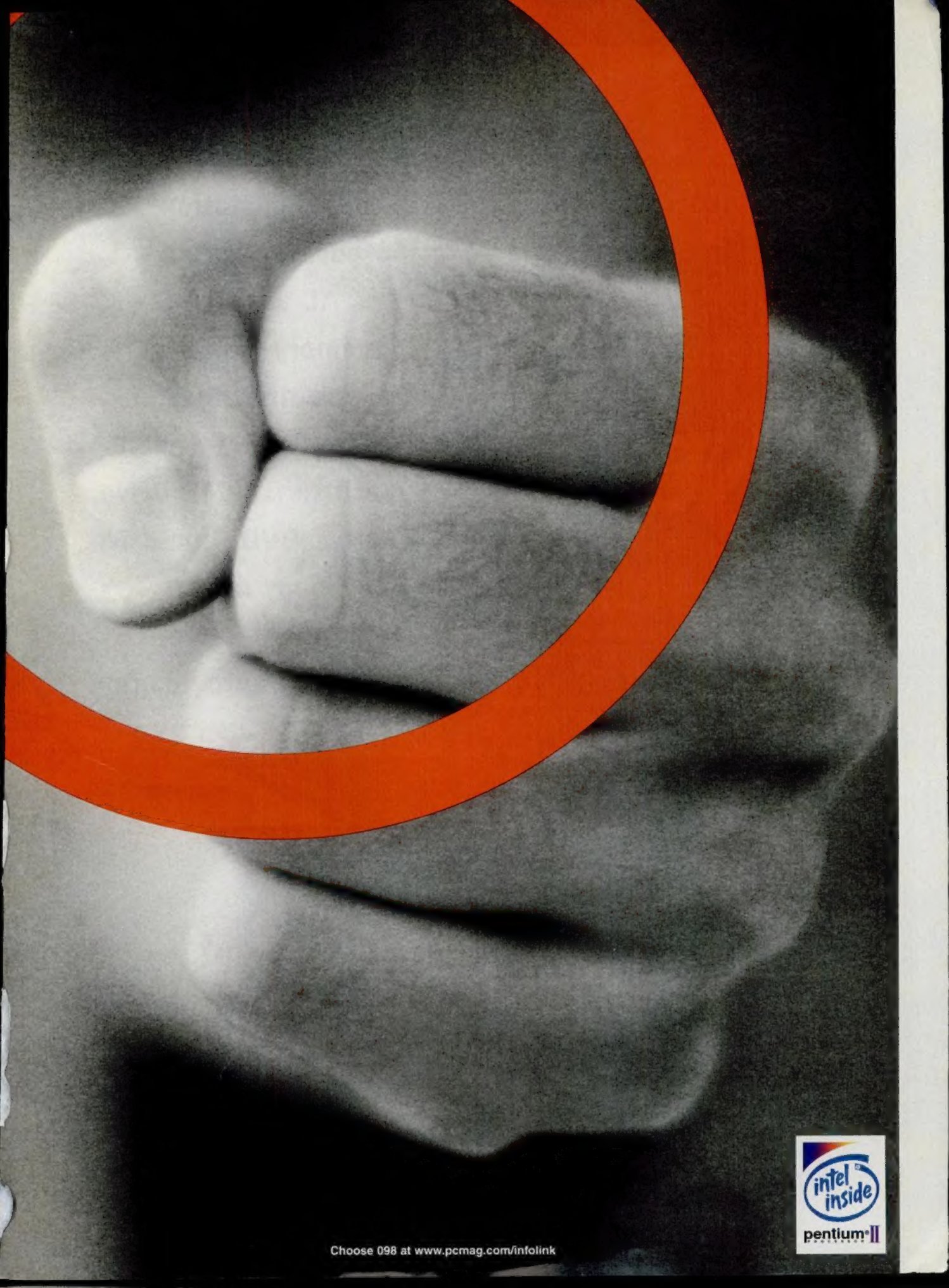
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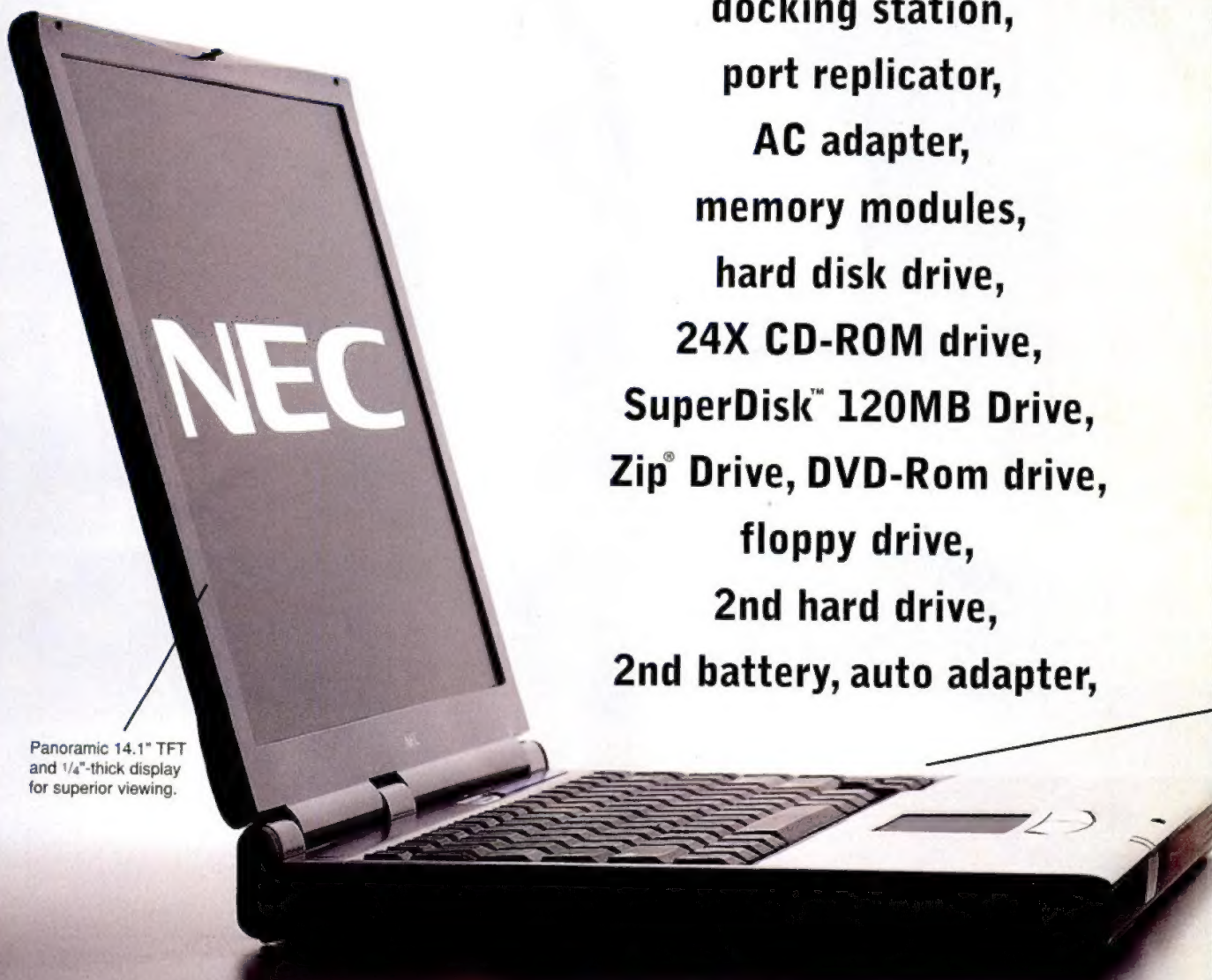




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Your Personal Robot



Did you spend hour after hour as a child attempting to build structures with a LEGO set? And when you got older, did you ever try creating a device from an electronics kit?

I know I did, and I bet many of you did as well. I remember building everything from buildings to trains with the LEGO set, and I have fond memories

process is much like snapping blocks together to make the physical robot. The program blocks include various commands, such as monitoring the various sensors, turning motors on and off, pausing for a certain amount of time, and so on. By putting sensors and motors in the right places and creating the right programs, you can easily make your robot do the basics, such as moving

of helping a friend assemble an early personal computer from a Heathkit, soldering gun and all.

All this came flooding back as I recently spent a few days playing with one of the coolest new toys I've seen in years: the LEGO MindStorms Robotics Invention System, which was developed in conjunction with the MIT Media Lab (see our First Looks Online review at www.pcmag.com). This new construction set not only lets you build a robot out of LEGO blocks but also lets you program it to do all sorts of fun things.

At the heart of LEGO MindStorms is something called an RCX, effectively a tiny computer inside a LEGO block about the size of two decks of cards. The RCX includes connectors to take input from several sensors that come with the product and to send output to things like motors. LEGO MindStorms comes with one light sensor, two tiny motors, and two touch sensors that can tell when your robot has collided with something.

It's really quite easy to build a robot with LEGO MindStorms. The basic system comes with more than 700 LEGO pieces including all sorts of things, such as wheels, tires, tracks, and blocks in almost every shape and size imaginable. The types of pieces are far more varied than when I was a kid. As a result, it's pretty easy to build something that looks fairly impressive and is uniquely yours.

But the real work is in making your robot actually do what you want it to do. You create a program on your PC, then download it to the RCX inside your robot via an infrared connector that attaches to the PC's serial port. LEGO has created its own programming system, which looks a lot like snapping together a bunch of program "blocks" on your screen. In fact, the

back and forth, turning around when it hits the edge of a table, or even following a track.

The system comes with a bunch of "challenges," which teach you how to control your robot while teaching basic robotics principles. In fact, it was pretty easy to start with the designs in the test program and in only a couple of hours create a robot that could do basic functions. After a while, I found myself designing robots that could do things like flip over backwards. I had a lot of fun creating these robots, and as I've said, it brought back a flood of childhood memories.

There are some caveats here. At a list price of \$200, LEGO MindStorms is fairly pricey, though it does include a lot of different things. There are many different LEGO pieces, so it is sometimes hard to find the piece you're looking for, either for your own projects or just to follow the sample projects LEGO suggests. Programming starts simply but can get more complex in a very short period of time (and the 1.0 release has a few quirks, such as occasionally making you restart your robot and reload firmware). And this isn't a toy for little kids; the box suggests that it's aimed at ages 12 and up.

But I suspect LEGO MindStorms may find a pretty big audience among the fathers of those children. If you have fond memories of spending hours putting things together just to see how they work, check this out. You'll be building your own robots faster than you think.


MICHAEL J. MILLER

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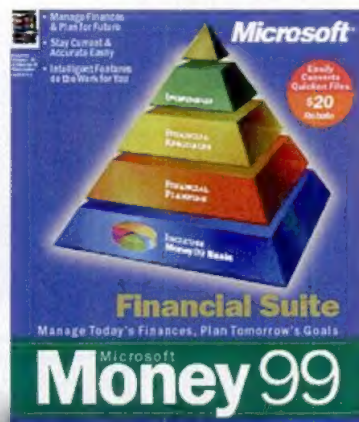
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WINLIST Windows Magazine, October 1998, James E. Powell



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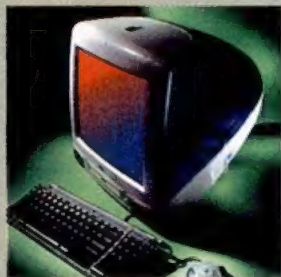


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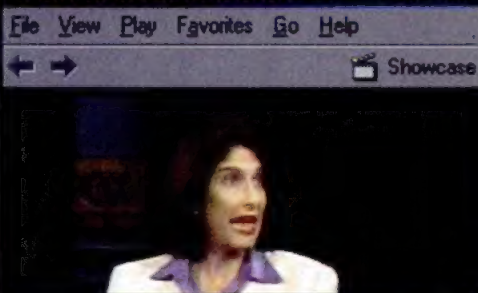
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SOFTWARE PREVIEW

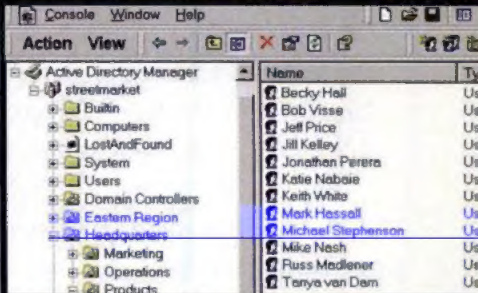
BY GAIL SHAFFER

Come along with us on a tour of the software you may be installing on your desktop and server PCs throughout next year. If you thought things would be settling down with all these products, you thought wrong. In some ways, things are just heating up—with lots of good packages coming for users100

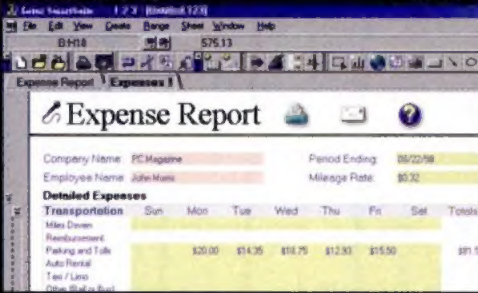
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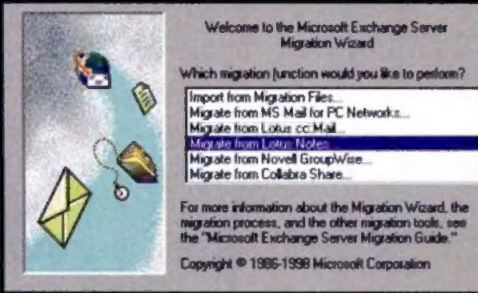
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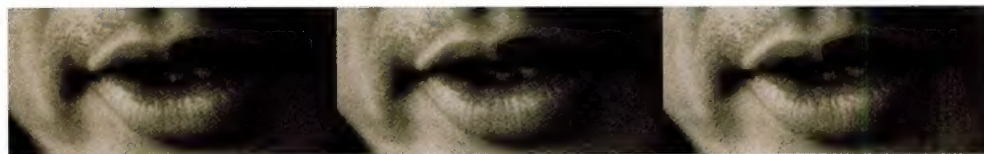
HARDWARE

25 Color Scanners: What's Now, What's Next



BY DANIEL GROTTA AND SALLY WIENER GROTTA
It's been a dramatic year in the scanner industry. Prices have been free-falling, and in this year's roundup, among the 25 color scanners we review, 5 are priced at \$100 or less. But the technology of scanning is changing just as rapidly, giving users new options—new tradeoffs, if you like. Everything is pointing to more and more scanners on more and more desktops—in the office and at home.....146

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Speech Recognition: Finding Its Voice

BY GREG ALWANG

Here's a market that's got everybody talking. Pun intended. Speech recognition is so compelling because it extends our most natural form of communication. But the technology is only now at the threshold of usability and productivity. You may want to jump in now and ride the wave as these products get better and better.....191



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Pipeline

Pocket Talk

The hand-held PC arena is experiencing a renaissance, with applications for devices such as 3Com's PalmPilot and Palm III and Windows CE-based hand-helds proliferating at an unprecedented pace. From voice recognition to database applications, PCs that fit in your pocket are expanding their horizons.

Applications such as voice recognition, GPS (global positioning system), databases, and presentations are especially promising for hand-helds. Santa Clara-based DSP Group, for example, has developed a tiny voice recognition chip for miniature cellular phones that won't require the use of keypads for dialing. Jan Abelev, DSP Group's director of marketing, says the chip is headed for hand-held PCs and will usher in a new breed of voice recogni-

tion apps. Meanwhile, Santa Clara-based Sirf Technology, working with Hitachi, has announced a chip set for cellular phones and hand-held PCs designed to bring GPS technology to the small devices.

Once GPS chips appear in hand-helds, mapping applications may be linked up with databases for hand-helds, to provide direc-



tories of restaurants and hotels.

Newer hand-helds also have better designs, such as Hewlett-Packard's new Windows CE 660LX with 32MB of RAM standard. Smaller versions of Windows CE devices and pagers with useful miniature keyboards are also arriving.

Cyber Grad School

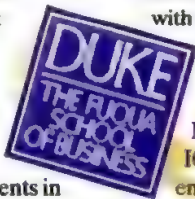
More executives—and would-be execs—are going back to cyberschool to get their MBAs. Enrollment at Duke University's Global Executive MBA program, part of the Fuqua School of Business, has doubled from 39 students in the first graduating class in '97 to 80 students in the class of '99.

Students in the 19-month "semi-synchronized" program are based in such far-flung locales as

Costa Rica, Finland, and Vietnam. They pony up \$85,800 (generally paid by employers) for the program, which combines residential classes—in Durham, Salzburg, Prague, Shanghai, Hong Kong, Sao Paulo, and Buenos Aires—with Web-based collaboration.

Faculty deliver lectures in RealAudio and hold "office hours" over Mirabilis's chat software ICQ. Microsoft NetMeeting, enhanced with DataBeam's Net120, is used for audio communication and document sharing.

Late-decision applications for the class matriculating in May are due by March 1.



In Search of Search Sites

38%

of respondents to a recent PC Magazine Online poll told us they typically start their Web searches at Yahoo! AltaVista came in second, with a 23 percent response, and Excite and HotBot tied for third, with 10 percent each.

Network Computers No More

Whatever happened to the network computer? In conjunction with Oracle's launch of its new software Application Server 4.0, Oracle CEO Larry Ellison recently backed off from boosting the network computer concept (in which an inexpensive, stripped-down PC without storage capabilities would make use of a server's resources) as it was originally conceived. Ellison had been a very vocal proponent of network computers, along with executives from Sun Microsystems, who remain committed to the idea.

Ellison acknowledged that the market for low-cost PCs had completely surprised him. "What surprised me was that

the first computer to [reach] \$500 was the personal computer," Ellison says. "Its primary use now is Internet access." Ellison also conceded that calling stripped-down machines Network Computers as a brand name was "naming stupidity," because Oracle



Oracle CEO Larry Ellison.

wants to shift away from "branding conventional, industry-owned standards."

The fundamental idea of low-cost machines that can run Internet-based applications is still a strong part of

Oracle's focus, though. The company's new Application Server is a key part of Oracle's effort to integrate database applications, electronic-commerce applications, and more with the Web.

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Pipeline

What's Selling at Retail?

Almost 27 million game titles were sold at retail in the first half of the year compared with around 16 million business titles, and five of the top ten software makers for the first half of 1998 were game developers, according to market research firm PC Data.

Based on unit sales in the U.S., Cendant Software ranks first, followed by The Learning Company, Microsoft, Intuit, GT Interactive, Electronic Arts, Broderbund, Symantec, Expert Software, and Block Financial. The number of titles Cendant markets has multiplied as it's gobbled up competitors. It now owns Blizzard Entertainment, Davidson & Associates, Knowledge Adventure, and Sierra On-Line, so Cendant has become the parent of such best-selling war games as Starcraft and Warcraft II.

From January to July of this year, business titles brought in \$1.3 billion in sales while games lagged behind at around \$619 million. The gaping difference is due to the high price of a business app (\$82) compared with that of a game (\$22). And the technical sophistication of games may account for why less than half as many game titles (4,000) as business titles (9,000) are on the market.

At retail stores, software games far outsell business titles, yet revenues are relatively small.

DOLLAR SALES
Business apps
\$1.3 billion



UNITS SOLD
Business apps
15.7 million



Source: PC Data. Data for January to July 1998.

Rankings (by units sold)

- 1 Cendant Software
- 2 Learning Co.
- 3 Microsoft
- 4 Intuit
- 5 GT Interactive
- 6 Electronic Arts
- 7 Broderbund
- 8 Symantec
- 9 Expert Software
- 10 Block Financial

Keyword: Women

As the face of the Web is changing, content targeted at women—both young and old—is on the rise. Women are expected to make up 42 percent of surfers on the Internet by the end of this year and 51 percent by 2002, according to market research firm eMarketer. And female consumers will spend \$3.5 billion online by 2000 for groceries, clothes, and books, predicts market research firm Jupiter Communications.

That's incentive enough for Web sites to cater to women. Last summer the Microsoft Network launched @watercooler for women in the workplace. iVillage.com has more than half a million members and gets about



70 million page views a month. And it's poised to get a lot more visibility from a recent deal with Lycos—which gets about 25 million page views per day.

Meanwhile, Yahoo! offers a site for senior women (and men), Yahoo! Seniors' Guide. Jupiter says that the fastest-growing age segment on the Web is 50 and older.

THIS ISSUE'S CONTRIBUTORS: Angela Hickman, Carol Levin, Sebastian Rupley, Don Willmont.

Stamping Out Stamps

Tired of sticking stamps on envelopes? You're not alone. Businesses both large and small are starting to find new ways to put postage on envelopes that involve neither stamps nor traditional mechanical postage meters.

Instead future word processing, content management, and accounting software will be "postage-enabled" with products such as E-Stamp's Internet Postage, NeoPost's PostagePlus, and StampMaster's Internet Postage. Any one of them will let



you purchase and download postage from the Web, verify addresses, and debit your account as you print postage directly onto envelopes.

The companies, together with the U.S. Post Office, are running trials, with software available next year.

Later this fall—pending U.S. Post Office approval—NeoPost expects to offer Simply Postage, a tiny printer that downloads postage from the Web and prints stamps. Since it won't have the advanced features of the other products, it can bypass beta testing.

Top-Selling Games

- 1 Starcraft Cendant Software
- 2 Unreal GT Interactive
- 3 Final Fantasy VII Eidos
- 4 Deer Hunter GT Interactive
- 5 Police Quest SWAT 2 Cendant Software
- 6 Rocky Mountain Trophy Hunter GT Interactive
- 7 Gabela's Big Game Hunter Activision
- 8 Diablo Cendant Software
- 9 Myst Broderbund
- 10 Titanic: Adventure out of Time Cyberflix

Source: PC Data. Data for July 1998.

Historic Digital Signing

The concept of digital signatures got a big boost recently when President Clinton and Ireland's Prime Minister Bertie Ahern digitally signed a communiqué document at a special ceremony in Dublin. To sign the document digitally, each leader inserted his smart card into a smart-card reader and entered a secret code.

The digital-signature system was developed by Dublin-based Baltimore Technologies. Digital signatures are an electronic means of signing and authenticating electronic documents in a secure manner for commercial applications.

The Piracy Plague

The worldwide software industry's revenue losses due to piracy are estimated at \$11.4 billion, with four in every ten business applications pirated. By contrast, the inventory shrinkage (from shoplifting and so on) for all U.S. retailers was less than 2 percent in 1997.



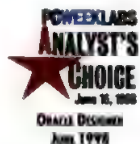
Sources: Business Software Alliance, Software Publishers Association.

53-year-old programmer starts a career in modeling



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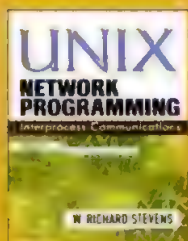
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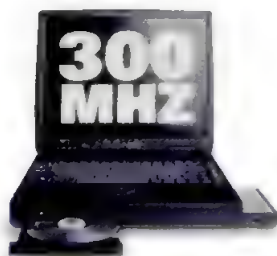
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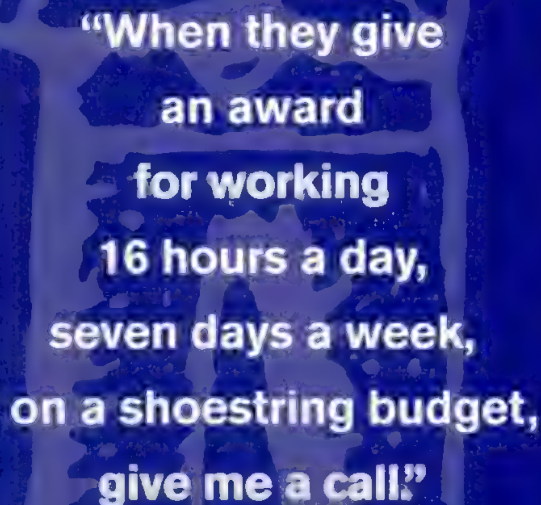


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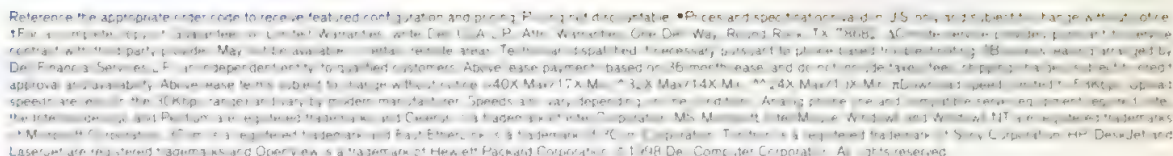
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matrox

Letters

PG FLATTERY

I realize these are the dog days of summer and there isn't much happening in the PC world right now, but did we really need another roundup of the hot technology companies? Why not leave this kind of embarrassing media flattery to *Forbes* or *Fortune* magazine? Instead of the same tired old bilge about visionary planning at Microsoft and millions earmarked for research, why not explain what this company really is—a shortsighted monopoly that has been fobbing off overpriced and substandard technology on the user community for over a decade? Next time you have a short news week, why not give us a backgrounder on why markets and innovation are shrinking because of Microsoft's predatory practices? An analysis of the long-term and far-reaching effects of defective OS technology on an industry, the implications of the user's acceptance of mediocrity in the market place? You conclude that Microsoft has "more control of the computer than any other single company." This is not cause for celebration; it is cause for alarm.

W. B. FANKBONER
La Quinta, CA

ABSOLVE ABERDEEN

The treatment of the Aberdeen Inverness D20 system in your "\$999 PCs" (September 1, 1998) was ridiculous. Not only did you point out three times that the CPU was overclocked to 343 MHz, you didn't post the system's results. Overclocking is hardly the big, bad demon some people think it is; in fact, it's quite the opposite, because it enables those of us who want to eke out the last bit of power in our systems to do so. I simply use an oversize heat sink and fan to keep the system cool. In these days of buggy software releases that essentially require end users to become beta testers, I find your treatment of Aberdeen unfair.

TIM REGOORD
via the Internet

THE RIGHT STUFF

Where were the articles describing why Intel has failed to catch up with—much less surpass—IBM/Motorola in your feature story "The Right CPU for You" (September 22, 1998)? The PowerPC processor has been in the lead now for over two years in terms of real-world performance. And it's taken a commanding lead in the race toward the next-generation copper chip. Further, Intel's Merced is delayed yet again until 2000. In the future, I suggest comparing all the processors that are available in the market for your roundups, as an informed consumer is a happy one.

CHRIS MARCH
via the Internet



"Did we really need another roundup of the hot technology companies?"

HOME IS WEB

Regarding your story "Home on the Web" (September 1, 1998): How can you say that America Online is the last of the true online services? CSI (CompuServe) is still alive, though its owner (AOL) may be slowly strangling it. CSI is definitely an online service and still provides a wide breadth and depth of content to its customers. I did like your review of the Web portal Excite. I wish, however, that the site provided its customers with storage space for a home page.

RANDY EVERETTE
via the Internet

I found your article "Home on the Web" to be interesting and informative yet incomplete. Contrary to your review, I have not found Yahoo! Chat to be difficult in any way to access or use. And in one place you claim you "cannot click on a name and bring up a profile" while in a chat room. In fact, you can get a profile not only by clicking on a name in the room list but also by clicking on that name in the room itself. You also have the option of sending a private message. If you click on your own name, you're given the option of editing your profile right then and there. As for Yahoo! Mail, true, it's not flashy, but you forgot to mention that it gives you the capability to send file attachments. You also seemed to gloss over Yahoo! Pager, which is more than an "instant message client"; from Pager you can also go directly to the Yahoo! home page, to access the online games, to chat, read personal ads, post messages, check classifieds and e-mail, get stock quotes, and personalize Yahoo! Pager.

If Yahoo! got such a dismal rating from you, Excite must be cyber-nirvana!

KEVIN GOULD
via the Internet

SECONDS, PLEASE

Your second look at Microsoft FrontPage in "Work Around the Quirks" (September 1, 1998) hit the nail on the head, but you left out some of the software's most bizarre quirks. For example, FrontPage has no way to record a log-on and password during Web uploads to an external server. In fact, FrontPage insists on supplying you with an erroneous log-on name, automatically and incorrectly derived from the local machine. Second, if you download a file from the external server to the local machine and then delete it from the local machine, every time you upload a document FrontPage says: "You have deleted FileX from the Local Web. Do you want to delete it from the server too?" It will ask this upon upload after upload after upload, no matter how many times you click No. Third, if you're not using Cascading Style Sheets in the editor, the software doesn't remember custom palettes for the page currently loaded.

ARTHUR BERKELL
via the Internet

I SEE YOU

Steve Rigney's story "Windows Networking 101" (September 1, 1998) was a good, brief overview of simple networking. I wonder, however, if he may have overlooked one very important dialog, the Networking Identification tab (Start/Settings/Control Panel/Network-Identification). I'm certainly no networking expert, but when I've set up very small peer-to-peer networks I've found that systems will not "see" each other across the network unless they are all in the same workgroup on this dialog and each has a unique computer name listed there. My company has two mobile showrooms where we display/demonstrate hardware that we sell. I use the same workgroup name for the mobile showroom network and my office network. I assign computer names that are unique on both networks, as well as TCP/IP addresses unique to both networks. Then, when I'm working in the mobile showroom, I just plug my office laptop into the network there and it "stands up" seamlessly.

MIKE BLEVINS
via the Internet

WINDOWS 98: A MIXED BAG

Thanks for your continuing coverage of Windows 98 ("Windows 98 Put to the Test," August 1998). *Time Daily* (August 11, 1998)

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Letters

reported that Microsoft would be giving the upgrade away free at the Microsoft Web site as of August 18. I went to the site and discovered that the information was incorrect. Apparently, only bug fixes can be downloaded free. I then went to a local computer retailer where the new PCs had Windows 98 installed. After playing with the program for about an hour, I found some neat improvements over its predecessor, but nothing worth \$95. Windows 95 was a true revolution in personal computing. By contrast, Windows 98 is an overhyped, overpriced, and bug-plagued experiment that is likely to fail.

J.C. RANDERSON
via the Internet

On pages 4 and 100 to 139 (August 1998), Windows 98 is called an "upgrade" that adds new bells and whistles and, equally important, fixes some "3,000 bugs" in Windows 95. But on page 321, in PC Tech, the subheading says, "A technical overview of Microsoft's newest operating system" (and then goes on to discuss Windows 98). Which is it, an upgrade of Windows 95 or a completely new operating system? The answer is important to thousands of Windows 3.x users who want to buy new computers (all of which now carry Windows 98) but are afraid that a Windows 98 "new operating system" will not allow them to transfer and use 16-bit programs and files as Windows 95 would have.

L. LANE
via the Internet

Windows 98 is the latest operating system from Microsoft, but it is also an upgrade from Windows 95. If the 16-bit software you run under Win 3.1 will run under Win 95, it will also run under Win 98.—Ed.

How to Contact Us

We welcome your comments and suggestions. When sending e-mail to Letters, please state in the subject line of your message which article or column prompted your response.

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that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.

Corrections and Amplifications

In the September 1 issue, John Dvorak incorrectly reported in Inside Track that Princeton makes a 17-inch display, complete with a video card that produces a resolution of 1,024-by-768 and sells for under \$1,000. The monitor is actually 14 inches.

In the ISP Information table in "The Road Warriors Guide" (August 1998), IBM should be listed with 1,330 POPs instead of 100.

REV IT UP

S. Jae Yang's Inside PC Labs column "A CD-ROM Rating You Can Trust" (September 1, 1998, page 29) tells only half the story. I'm happy that PC Labs has added the Transfer Rate Inspection test to ZD CD-ROM WinMark, but PC Labs is overlooking one of the most important characteristics of CD-ROM drive design: the controller's ability to minimize seek latency times. When a typical high-speed CD-ROM drive is not accessing the disk continuously, it spins down. When it spins back up you hear the disk revving up to speed, and then finally the application jolts back into action. This never used to happen with my trusty 2X CD-ROM drive.

I think PC Labs needs to look more closely at a drive's real-world latency times and put less emphasis on the transfer rate. After all, a superfast transfer rate typically comes into play only once, when the program is first being installed. After that, if a running program accesses data off the CD, you better hope it keeps the controller busy, because if it doesn't, you're in for a jerky ride.

DAN CAPUTI
via the Internet

COMPUTER WARS

In "DOJ and Microsoft Should Settle Their Differences" (September 1, 1998), Jake Kirchner wants PC Magazine readers to believe that the Department of Justice is Darth Vader and Bill Gates is Luke Skywalker, and that they're struggling for the soul of computerland. His emotional rhetoric parrots Microsoft's repeated claim that Microsoft wants only to be allowed to "innovate." But his empty arguments have no foundation in fact. Every one of Microsoft's mainline products was copied from Adobe, Apple, IBM, Intuit, Lotus, Novell, Stac, WordPerfect, Xerox, or other software companies. Microsoft is not an innovator, it is a predator that gobbles up emerging markets by forcing cloned software (such as Internet Explorer and Outlook) onto the consumer while squashing competitors that already offer similar products.

Want to see real innovation? Break Microsoft into two separate companies, one selling operating systems and the other selling applications. Force the operating-system company to work with all software vendors to develop the operating systems of the future, and force the applications company to compete in the marketplace, without under-

the-table technical and marketing help from the operating-systems company.

NAME WITHHELD
via the Internet

MELANCHOLY MACHRONE

As an amateur musician and programmer, let me take a stab at rewriting the last paragraph of Bill Machrone's September 1 editorial ("Those Pesky Copyrights"): "The computer program is one of humanity's highest forms of imagination (to some, art), a confluence of logic and symmetry that, at its best, can make a lifelong impression, convey our deepest thoughts, make us laugh, or rally an economy. It transcends the programmer and attains a life of its own. It should be able to spend some portion of that life online, legally." Where shall the copyright line-in-the-sand be drawn?

BRUCE PRICE
via the Internet

STEAMING SEYMOUR

I know what Jim Seymour is talking about in his September 1 editorial ("PC Industry: Don't Buy That New PC!"). He wrote about the anger and frustration experienced when upgrading from one Windows 95 PC to another. I've had the fortune and misfortune to upgrade from a 133-MHz Toshiba 510CDT to a 266-MHz 550CDT. I chose this approach because they both use the same docking stations and are therefore quite compatible. I operate through a network while in the office, so I used this as an opportunity to transfer all of my data files to the network drive, as well as some applications that I knew were self-contained and would function without having a formal "install." Boy, was that a mistake!

After receiving the machine from our IS group partially loaded with Windows, Office 97, and the network and Notes applications, I began to load the rest (graphics programs and the like). When I copied the .ini files and rebooted, the system was unable to find certain file associations and crashed, hard. This apparently was caused by also copying over the 510's System.ini to the 550. After getting the technician to attempt to fix it, we were forced to use Toshiba's "save your life" disk to reformat the hard disk and reload Windows 95. We were forced to spend an additional day and half reloading all of the programs that got destroyed in the reformat operation.

MYLES MARCOVITCH
via the Internet

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Trends

The Big Test

Before a CPU sees daylight, it undergoes years of tests.

Try to imagine building a scale model of Manhattan that would fit on the end of your thumb, duplicating every street, bridge, tunnel, skyscraper, and corner deli. Fifth Avenue would be several times thinner than a hair from your head.

Then imagine simulating yesterday's New York traffic on your model, guiding thousands of virtually invisible cars, trucks, trains, buses, and bicycles down the many roadways, across the many bridges, through the many tunnels, and around the many pretzel vendors. You mustn't let slowdowns occur, and everyone should get to where they're going exactly when they're scheduled to do so.

Now imagine doing a similar simulation for every traffic scenario that could ever conceivably occur, ensuring that your model will never produce an accident or even a slowdown. Validating a microprocessor is more difficult.

Processor manufacturers devote extraordinary effort to validation—in which each new CPU architecture is tested for design, manufacturing, and compatibility flaws. "Today, all the major chip companies have their own [validation] test suites," says Linley Gwennap, editorial director of *Microprocessor Report*. "Intel's is likely the most complex—they've been at it longer and have more money to put into it—but the others have extensive suites as well." As a group of *PC Magazine* editors learned on a recent visit to Oregon, Intel spends hundreds of millions of dollars a year on validation, testing each chip from its conception up to its last days of production. Much like the preposterous task of simulating traffic on a microscopic model of Manhattan, it's a miniature task of epic proportions.

Consider Intel's Pentium Pro, a processor that consists of nearly 5.5 million transistors. If you decided to validate each and every one of the chip's potential states, you'd have to examine 25.5 million combinations. That's a 1 followed by 1.6 million 0s, and it doesn't even begin to explain the scope of validation. A mi-

croprocessor, after all, must smoothly interact with its chip set, an L2 cache, a memory subsystem, thousands of hardware peripherals, hundreds of thousands of software packages, and millions of exacting customers. "Wrap all that together," says Gerald Budelman, senior manager of server validation engineering, "and validation is approximately impossible."

You can't validate a processor by systematically checking every potential state. Today's manufacturers will never ship a processor that's errata-free, but they can—with months of continuous, specialized, and extremely expensive testing—deliver a working, reliable product.

Even before an Intel chip reaches silicon, it's modeled

in software and tested for months, around the clock and across the globe. Initially, processor functions are simulated at remarkably slow speeds from 2 to 5 Hz. Whereas a 400-MHz chip fits 400,000,000 clock cycles into every second, its software test model manages 5 at the most. "Windows would not boot in your lifetime," says Budelman. But at 5 Hz, it's easier to spot potential bugs and determine their causes.

Subsequently, Intel may model the chip with macroscopic electronics, creating a literally room-size processor that connects to a standard PC platform and runs standard software. Built at a cost of roughly \$8 million, the macroscopic Pentium Pro model clocked at 150 KHz and ran most major operating systems.

Once the chip is rendered in silicon, it's validated on dozens of so-called Diamondback systems—souped-up PCs with \$150,000 price tags. Typically, each pair of Diamondbacks shares over \$200,000 in instrumentation, including full logic analyzers, PCI monitoring tools, and temperature controllers.

Before the chip goes into production, compatibility tests are run with hundreds of hardware peripherals and thousands of software applications. Even after a chip reaches production, validation continues. Each new chip is tested while still on the wafer and after it's packaged.

This entire process takes nearly two years, yet it still fails to find every bug. "In addition to becoming more powerful over the past few years," says Gwennap, "processors have taken on more and more complex functions: the floating point, the primary cache, often a secondary cache. There's more and more potential for test suites to miss something." More than 50 errata—all unlikely to affect everyday PC operation—have been found in the Pentium II since

it shipped to customers. This is not to say that today's validation techniques are deficient. On the contrary: It's a great tribute to today's manufacturers that their processors operate as well as they do.—Cade Metz



TEST-BED ON PASTA MAKER? Intel's Diamondback system makes sure silicon is in working order.

Members Only!

Private chat clubs are here.

The enormous popularity of Web-based chat rooms is opening up new horizons for commercial Web sites and portal sites. Yahoo! has introduced a new offering at its site called Yahoo! Clubs, where registered Yahoo! visitors can create their own forums for discussing special interests. Excite is testing a similar offering.

To create a club at Yahoo!, you don't need HTML skills. You begin by going to the Clubs Web site (<http://clubs.yahoo.com>), where you can browse more than a dozen subjects and choose the category that best suits the club you want to create.

Founders are given the administrative rights to moderate and modify their clubs and can opt to share these rights with other individuals. Excite expects to have an offering similar to Yahoo! Clubs by the end of September.

"By establishing a personal Web community, individuals have their very own place on the Web that they can participate in and keep coming back to on an ongoing basis," says Tim Brady, vice president of production at Yahoo!.

Common bonds and interests have been a primary reason why many chat forums fragment into smaller groups, which then conduct their chats through private e-mail addresses.

Web-based chat is already looking as if it may become a big revenue stream in and of itself at some sites. Would you pay \$525 a



month to join a chat room? That's what people do at Pristine Day Trader, where analysts and editors make real-time stock-trading recommendations online.

Chat revenues may also be in the picture for educational applications. For example, the University of Massachusetts, the Wharton School of Business, and ZDNet (which is PC Magazine's parent site) all offer online classes in chat format.—*Sebastian Rupley*

INSIDE



PC LABS

Scanner Quality: The Naked Truth



In the market for a scanner? As you pore over the optical- and mechanical-performance data on the scanners reviewed in this issue's feature story "Desktop Scanners: What's Now... What's Next," consider this: All the impressive test results and manufacturer specs (such as 36-bit color depth and 3.0 dynamic range) must, in the end, result in images that please your eyes or they mean nothing.

In recognition of the subjective nature of testing image quality, PC Magazine

Labs added to our objective computer-based tests with jury-testing using the critical eyes of our staff. After all, the ultimate judge of a scanner's performance is the human eye.

The best way to conduct a jury test is to compare each scanner's sample image with every other image in a comprehensive series of A/B comparisons. This method, however, creates a huge permutation of comparisons. Jury-testing all 25 scanners this way would require 300 comparisons.

Faced with this obstacle, we implemented a commonly used computer-programming algorithm called *insertion sort*. (The insertion sort is similar to but more efficient than the better-known *bubble sort*.) With the insertion-sort strategy, we were able to reduce the number of comparisons each of our 16 jurors had to make to about 150.

We placed all of the output samples randomly in one row for each juror to sort in the order of best to worst, with the best ending up on the left. To ensure fairness, we coded each sample, and the key to the codes wasn't available until the end of the jury test. Each juror started by picking up

the image located second from the left and comparing it with the first one in the row. If the second image was better than the first, then the juror swapped the positions. Next, the juror picked up the third image and compared it with the second and the first if necessary. The juror then repeated this process down the line until the last image.

This simple procedure ensured that when the juror picked up an image, all the ones to its left were already sorted. By comparing an image against only one image to

the left and swapping positions as necessary, the juror needed to compare only until a better one was found. Effectively, the juror was inserting each image into a sorted array.

We didn't fully realize how wide-ranging scanner quality could be until we placed the sample images next to one another. We also found that the specifications and measurements couldn't tell us everything about how the scanners' images appeared to the naked eye.

For example, the high-end Epson Expression 636 Artist 2 has an impeccable

data sheet and impressed our jury with its accurate reproduction of the original image. Yet our jurors liked the vibrant, faithful colors in the scan sample of the Hewlett-Packard 6250C just the same, even though this scanner had some flaws in our computer-based measurements.

Based on the results of our insertion-sort test, we recommend that when shopping around for a scanner, you consider not only the model specifications and the performance ratings but also the quality tests performed by our human jurors.

After all, seeing is believing.
—*S. Jae Yang and Win Swarr*



WE, THE JURY: A juror performs the insertion-sort routine, ranking each scanner sample into a sorted array from best to worst. The wide range of scanner quality in our testing was apparent only when we put the sample images next to one another.

Got the Time?

Network Time Protocol (NTP) helps computers stay in sync.

For those who have wondered how widely dispersed networks of computers manage to stay in sync, the answer is in the air—literally. Coordinated Universal Time (UTC)—an international standard—is broadcast by shortwave radio stations, such as WWV and WWVB near Fort Collins, Colorado, and WWVH in Kauai, Hawaii. Also transmitted by satellite and modem, UTC connects with computers the world over via Network Time Protocol (NTP). NTP goes back nearly 20 years, so it's the longest-running Internet protocol.

With the exponential increase in electronic commerce, it's gaining increasing importance through its provision of a widely accessible, standard reference clock. NTP can keep clocks accurate to within 10 milliseconds over a wide area network spanning thousands of miles. This makes it possible to prevent confusion

about the priority and timing of financial transactions.

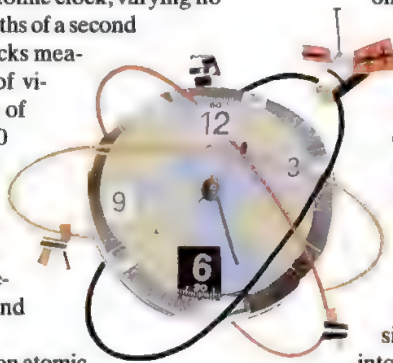
NTP is linked to the official time of the United States, maintained at the U.S. Naval Observatory in Washington, DC (<http://tycho.usno.navy.mil/time.html>). The USNO Master Clock is an atomic clock, varying no more than 0.3 millionths of a second per year. Atomic clocks measure time in terms of vibrations of an atom of cesium: 9,192,631,770 vibrations per second. That number of vibrations is not an approximation: It is, by international agreement, the way a second is defined.

More information on atomic clocks is available through the National Institute of Standards and Technology (NIST), Time and Frequency Division, located in Boulder, Colorado (www.bldrdoc.gov/doc-tour/atomic_clock.html). Other time-standard stations include the National Physical Laborato-

ry (NPL) of the United Kingdom, the Physikalisch-Technische-Bundesanstalt (PTB) in Germany, and the Australian National Measurements Laboratory. At present, about 70 public primary time servers distribute accurate time information to over 100,000 secondary servers and clients all over the world.

While NTP keeps computers in sync to within milliseconds, there's some concern that Y2K may put substantial numbers of computers 100 years out of sync. This could happen even if NTP's design and implementation are thoroughly Y2K-compliant, because of the possibility that errors will be fed into NTP by one or more reference

clocks. For this reason, NTP users are being advised to make sure that the primary time servers upon which they rely are accessing more than one reference clock and are checking each other for accuracy as Y2K approaches.—Marc M. Groz



JAKE KIRCHNER

Today's PC: Inexpensive and Obsolete

Anyone watching PC prices lately has seen that one of the major stumbling blocks to wider use of PCs—price—has been hurdled. We're seeing full-featured name-brand systems, including monitor and printer, selling for less than \$1,000.

That other significant stumbling block—ease of use—shows no sign of budging. But lower prices will motivate many new buyers to overlook that issue. PCs may not be any easier to use than they were two years ago—or ten years ago, for that matter—but they sure are less expensive, and that's good for every buyer.

And the prices are still dropping. Of course, they can drop only so far, and soon they may not fall as dramatically as in the last several years. Think of TVs. Color TVs are pretty cheap these days, but they aren't much cheaper than they were five years ago. At some point the cost of basic components just can't go much lower, and that will happen for PCs soon enough.

With prices nearing bottom and ease-of-use issues giving way slowly, it's time to consider what in my opinion is the greatest and most intractable problem of personal computing—built-in obsolescence. You can't buy a computer without its becoming obsolete within a few years.

I walked around my house the other day mentally cataloging some of the "old stuff" we still have in use—the 10-year-old GE refrigerator, the 12-year-old Nikon SLR camera, the 16-year-old RCA color television, the 25-year-old Sony stereo amplifier and Advent speakers. With an occasional adjustment and repair, they just keep doing their jobs year after year.

What they have in common is more than just good brand names.



More important, they aren't computerized. That means they don't carry the computer curse of built-in obsolescence. New models of, say, my refrigerator, will have more bells and whistles; but the old one does the job I bought it for as reliably as the day it was delivered. The PC I bought 15 years ago couldn't even function as a plant stand today.

The upgrade option for PCs has never been satisfactory. Do you realize that you would have to spend more money upgrading the components that need replacing than you would if you just bought a new computer? You can't just buy a new CPU; you need a new motherboard, you need a faster graphics card, you need a faster modem, and on and on.

The worst part of this curse is that with computerization extending to lots of different products, the obsolescence problem is creeping far beyond computing. My Nikon SLR takes great pictures after all these years. The digital camera I bought a year ago is embarrassingly obsolete. My 15-year-old TV will last another 5 years. If I replaced it with a PC/TV today, I'd be looking for a new one in 3 years.

The problem will just get worse as PCs gain a greater foothold in appliances, consumer electronic devices, and cars. The only way to solve this problem is to rethink the way computers are designed. The industry needs to develop ways to upgrade computers and computerized devices simply and inexpensively—without swapping out suddenly outmoded components, without constantly changing technical standards, and without buying new boxes. If we can improve our designs and manufacturing methods to allow for lower prices, we should be able to conquer the obsolescence factor as well.

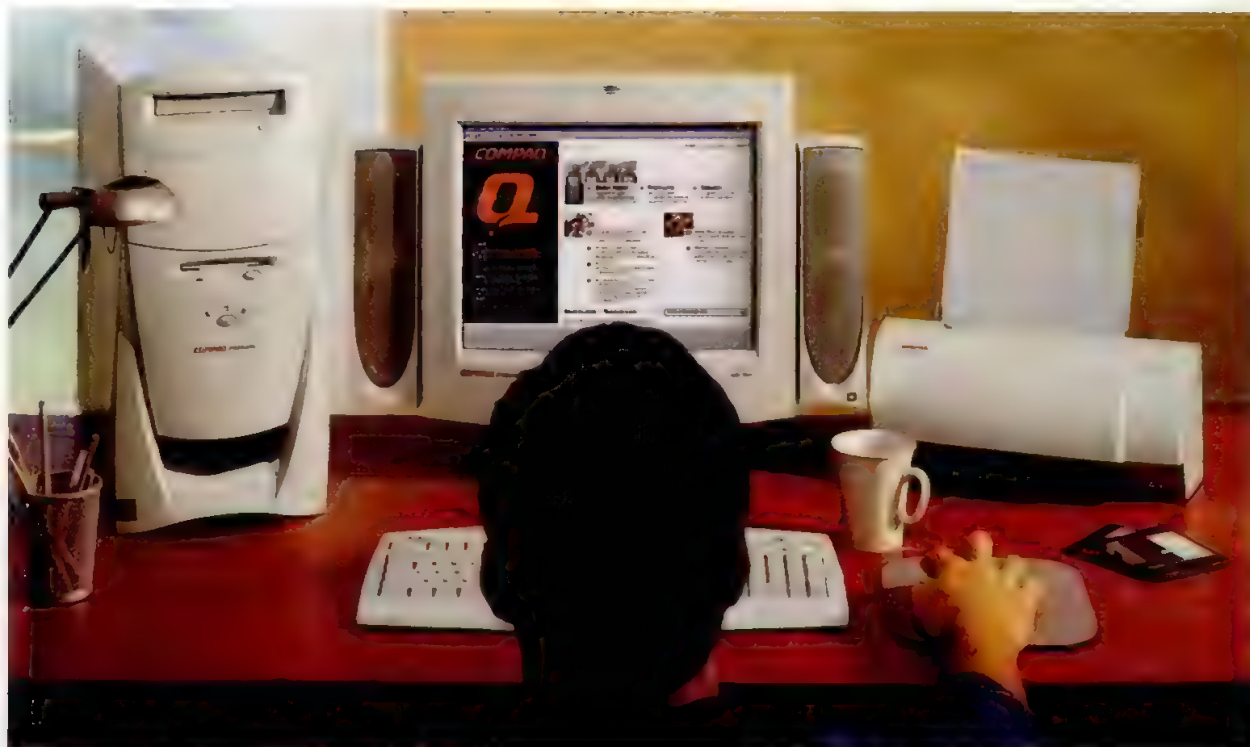
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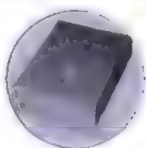
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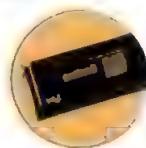
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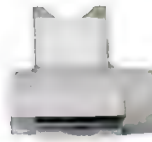
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NOTEBOOKS

The New Bottom Line in Value

Judging from recent price cuts on the notebook market, the \$999 portable isn't that far away. Desktops have been selling with sub-\$1,000 price tags for more than a year now, but with notebooks—always a generation behind in cost and proficiency—such price points

are an entirely different matter. Though antiquated portable hardware has long been available at low prices, this is the first time that notebook designs relatively close to the high-end are reaching the \$1,200 to \$1,400 range.

This new market segment has its roots in the Toshiba Satellite 305CDS, a consumer portable from Toshiba America Information Systems, the industry's leading notebook vendor (800-457-7777, www.csd.toshiba.com). Built specifically as a value machine, this seminal portable debuted in January of this year at \$1,699—then an unheard price for a freshly designed 166-MHz Pentium MMX with a 12.1-inch dual-scan display, 16MB of RAM,

256K of secondary cache, and a 2GB hard disk.

Since then, notebook prices have dropped dramatically. Toshiba is now selling the **Toshiba Satellite 2505CDS**—a similar system with a 233-MHz Pentium MMX, 512K of secondary cache, and 32MB of

RECAP

PC Magazine's annual notebook roundup looked at 24 value systems. The Gateway Solo 2500SE was awarded Editors' Choice.

memory—with a price of just \$1,400 (street). This three-spindle machine also features a PCI graphic accelerator

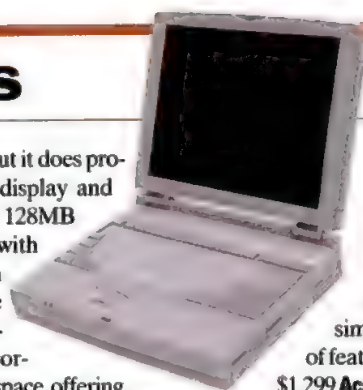
(2MB of video RAM), Yamaha sound, a 20X CD-ROM, a standard floppy disk drive, and a lithium ion battery, as well as a 56.6-Kbps PC Card modem and a consumer-oriented software bundle. Toshiba offers a one-year parts-and-labor warranty.

After conducting an ad audit of the industry's leading computer magazines, WinBook Corp. (800-254-7806, www.winbook.com) is billing its \$1,199 **WinBook XL** as "the lowest priced 233-MHz notebook in America." The system is built around an Pentium MMX processor, a dual-scan display, only 256K of secondary cache, and just

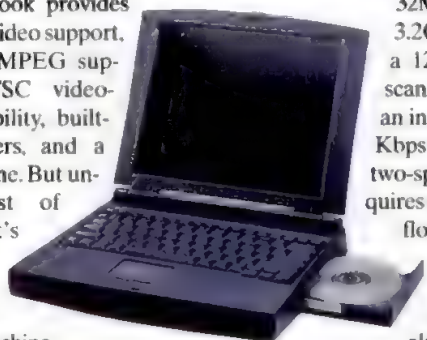
16MB of RAM, but it does provide a 12.1-inch display and support for up to 128MB of memory. As with most notebooks in this inexpensive class, the WinBook also cuts corners on hard disk space, offering only 1.6GB standard.

Not only is the PC's graphics accelerator with 2MB of RAM and 16-bit stereo audio integrated, but WinBook provides Zoomed video support, software MPEG support, NTSC video-out capability, built-in speakers, and a microphone. But unlike most of WinBook's

portables, this three-spindle machine—loaded with a 20X CD-ROM, a floppy disk drive, and a nickel hydride battery—does not offer two simultaneously operational pointing devices; rather, it features only a touchpad. A three-year warranty—to replace the unit's standard one-year plan—and an integrated 56.6-Kbps modem are each available for an additional \$159.



VALUE STAND:
Notebooks from Toshiba (above) and WinBook.



One step above the WinBook XL on the pricing ladder—but somewhat similar in terms of feature set—is the

\$1,299 Acer Extensa 3680 from Acer America Corp. (800-733-2237, www.acer.com/aac). The system is a 233-MHz Pentium MMX with 32MB of RAM, a 3.2GB hard disk, a 12.1-inch dual-scan display, and an integrated 56.6-Kbps modem. This two-spindle unit requires you to use the floppy disk as an external attachment.

The system is also equipped with a 20X CD-ROM drive, a nickel hydride battery, a 128-bit graphics accelerator with 1.1MB of EDO video memory, 16-bit stereo sound, built-in speakers, a microphone, Zoomed Video support, and an external video port. In addition to bundling McAfee Anti-Virus, Lotus Organizer, and several other software titles, Acer backs the system with a one-year parts-and-labor warranty.

ARM Computer (800-765-1767, www.armcomputer.com) has reached this same \$1,299 (street) price point without settling for a dual-scan display, a 256K cache, or 16MB of base memory. The **ARM-Note TS1200**—built around a 12.1 active matrix display, 512K of cache, 32MB of EDO RAM, and a 233-MHz Pentium MMX—is a three-spindle machine integrating a 24X CD-ROM, a standard floppy disk drive, and a nickel hydride battery. Like the Acer unit, it offers just 2.1GB of storage space but integrates a 128-bit graphics accelerator. ARM augments the base machine—which also includes 16-bit sound, built-in speakers, and a microphone—with a free carrying case and a one-year warranty.—Cade Metz

DVD to the Max

With the introduction of **ExtremeDVD** systems and **DTV 34- and 38-inch XGA PC+TV Monitor** from NetTV (800-440-6388, www.net-tv.net), the distinction between PC and common appliance continues to blur. Sold retail at prices beginning at \$1,000, the ExtremeDVD is a home entertainment system designed primarily for high-resolution DVD playback and 3-D gaming. All NetTV models run on Windows 98 and come standard with a DVD drive, a hardware DVD decoder, Dolby Digital sound, a 56.6-Kbps modem, a floppy disk drive, and a wireless remote keyboard. Additional hardware varies from system to system.

The line begins with the low-end ExtremeDVD 2000—a 200-MHz AMD K6-based machine equipped with 32MB of RAM, a 2.5GB hard disk, and a 128-bit AGP graphics card (4MB video memory)—and stretches to the new, high-end ExtremeDVD 4000, which offers a 400-MHz Pentium II, 128MB of RAM, 8MB of video memory, and a 14GB hard disk. These machines are best when used with NetTV's large screen monitors, ranging from the DTV 29-inch (27-inch viewable flat screen) to the DTV 38-inch (36-inch viewable). Priced from \$1,000 to \$2,700 on the street, each is bundled with a handheld remote control and a 181-channel television tuner module, allowing for an easy upgrade to the upcoming Digital TV standard.—CM



GRAPHICS SOFTWARE

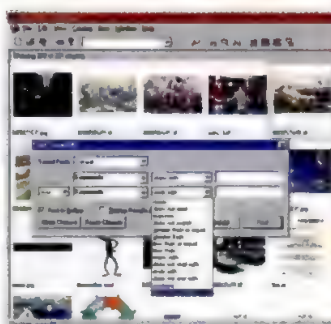
Next-Gen Media Managers

Thanks to the ever-growing accumulation of digital media that we deal with at home and at work, there's an increasing need for media management software. From simpler products that create catalogs of static images to programs that organize all types of multimedia, the software is out there.

Extensis Corp.'s **Portfolio 4.0** (\$200 street) is billed as an asset management database (800-796-9798, www.extensis.com). Portfolio helps you organize all of your media files—including Photoshop, QuickTime, PowerPoint, and various audio files. The HTML export feature lets you create and publish to the Web a catalog of thumbnails that can be used for file searching and retrieval.

Though Portfolio 4.0 can be

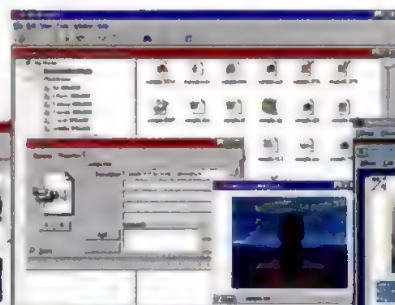
used as a client-side product, **Portfolio Server 4.0** (\$2,000 street, for 5 clients) adds useful server-side capabilities for network users. Multiple clients can now search and retrieve



files from the same image database, which in turn can be distributed across multiple systems.

G geared towards professional users, Portfolio goes beyond mere cataloging: Images can contain the

46 standard Associated Press information fields, as well as custom fields (tab-delimited files can be imported). The ability to search is crucial, since Portfolio can theoretically handle infinite images. (In practice, Extensis has cataloged



EASILY REFERENCED:
(from left) Portfolio 4.0, Arriba Express, and PhotoRecall 2.0.

500,000 images.) The keyword search supports up to five clauses.

In a similar vein, Arriba Soft Corp. (888-277-4229, www.arribasoft.com) has introduced **Arriba Express**. Arriba Express (\$100

street) provides a means of creating catalogs of all of your files, including text documents, images, or WAV files. Each file is treated as a Media Object, which can have unlimited attributes assigned to it, such as keywords or author.

The Windows Explorer-like interface provides a view in which the individual media folders you've created are displayed on



the left and thumbnails of the contents of those folders are on the right. You can perform a search for a specific set of files and have it saved for future reference as a subfolder of any given folder. Arriba Express supports viewing more than 450 file formats. Plus, you can create portfolios, export media to other file formats, and download Web sites.

For a simpler approach, there's **PhotoRecall Deluxe 2.0** (\$50 street), from G&A Imaging Ltd., (888-772-7601, www.photorecall.com).

PhotoRecall is intended for use by those dealing solely with images (i.e. BMP, GIF, TIF). This multifaceted consumer imaging product can be used to create searchable and browsable image databases; it also offers an image-editing component, can create slide shows (with audio narration), and helps you build Web pages via its HTML export.

Another company targeting consumers is Canon Software Publishing (800-652-2666, www.software.canon.com), which has released its previously announced **Photo Org** product (\$50 street). Photo Org offers basic image editing as well as support for building photo albums and Web pages.—Matthew Graven

PIMs

Internet-Friendly PIMs

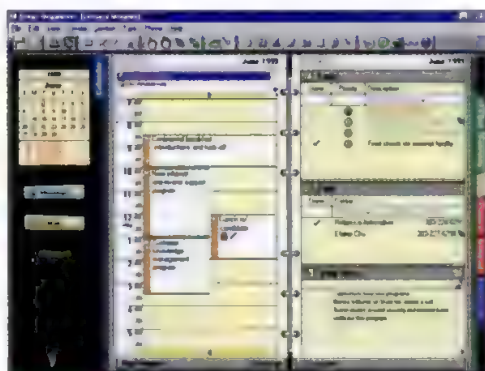
The latest generation of Personal Information Managers (PIMs) is helping users stay connected and up-to-date by focusing on software integration and maximizing Internet functionality.

Though Lotus Organizer is already a fairly mature product, Lotus Development Corp. (800-346-1305, www.lotus.com) is updating its popular PIM with the release of **Lotus Organizer 5.0** (\$80 street). Enhancements include new weekly time slots and day planner views, Timed Tasks and Calls, and print preview. Also new is support for the iCalendar standard, which allows you to schedule appointments and share your calendar over the Internet with other users that have PIMs that support iCalendar. Other new features: LDAP lookup, support for various Internet file formats, including vCard and vCalendar, and live

URL links in the Organizer notepad. EasyClip text entry simplifies copying data from any Windows program into Organizer. Road warriors in particular will appreciate the integration with the Official Airline Guide Travel Information System.

The forthcoming release of Microsoft Corp.'s **Microsoft Outlook 2000** (425-882-8080, www.microsoft.com) constitutes a major upgrade of Microsoft's PIM/messaging client. Currently in beta and due in early 1999 (pricing not yet determined), Outlook conveniently integrates e-mail messaging with calendaring, thereby making scheduling and maintaining contact information a breeze.

Outlook 2000 also supports LDAP, vCard, and iCalendar. It offers such new features as the Meeting Planner, which allows you to select attendees and search for available times, and the ability to publish your calendar on the Web. Flag and Follow-up



MARK THE DATE: Lotus Organizer 5.0 offers a convenient new user interface.

helps you prioritize messages and contacts, and the Message Recall feature allows you to cancel or replace a message previously sent to other Outlook users, provided they haven't already checked that message.—MG

**More customers came back
to Gateway last year than
any other computer company.**

Let's talk about why.



Let's talk about your **Gateway™**

call 800-846-7062



Let's talk about a better way to buy and own a computer.



Let's talk about loyalty. Three out of every four Gateway customers came back to Gateway last year.¹ No other computer company has fans so loyal. Why? Because we offer award-winning products at great prices, backed by unbeatable customer service and support. And to make buying and owning a computer even easier, we've come up with the Your:)WareSM program.²

With Your:)Ware, you buy a new GatewayTM PC with no money down, making monthly payments starting as low as \$49.95 a month for 48 months³—we build it just for you, with optional unlimited Internet access³. Best of all, you can stay on top of new technology, because after two years, you have the option to trade in your Gateway PC toward the purchase of a new one. Once you buy your first Gateway computer, you're a believer.



Introducing Your:)Ware.



Customized Hardware

With Your:)Ware you get to choose exactly what you want. And that's not even the best part.



Obsolescence Protection

The computer you build today will still be useful tomorrow because you have the option to trade it in toward the purchase of a new one in two years.



Internet Access

Convenient access to the World Wide Web is just a few clicks away on a PC that's specifically built to handle it. And with the Your:)Ware program, you can get unlimited Internet access*. Can we help you with anything else?



The Right Software

It doesn't matter if it's for a family of six; we can build a PC with software that's perfect for everyone. Tell us who's going to use it and for what purpose, so we can put together a system that fits their specific needs.



Service

After all that, you have to ask? Gateway Gold™ Service for G-Series PCs means you'll get quality service 24 hours a day, 7 days a week from the time we help you build your PC, on through the life of your computer.**



Low Monthly Payment

You can finance your computer through Your:)Ware for one low monthly payment.

A great place to start



Intel® Celeron™ Processor 333MHz with 128K Cache

32MB SDRAM

EV500 15" Monitor (13.9" viewable)

4MB 3-D AGP Graphics

6.4GB Hard Drive

DVD-ROM Drive & MPEG2 Decoder

Boston Acoustics® BA635™ Speakers

U.S. Robotics® 56K Voice Winmodem



Trade-in option in 2 years



Unlimited Internet Access†



Microsoft® Windows® 98 & MS® Home Essentials™



Gateway Gold™ Service* for G-Series PCs



As low as

\$49.95/mo.

for 48 mos or \$1259*

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Let's talk about your


Gateway™

*Prices do not include shipping and handling or any applicable taxes. Loan financing available on approved credit through independent lender. Payments based on 48-month term and an Annual Percentage Rate as low as 14.9%. Your APR may be higher. 2% access check fee (\$2min/\$15max), not applicable to Gateway purchases. Cash price does not include Internet access.

** Gateway Gold on-site and installation services are administered by PC Technology Services, Inc. for product (excluding mice, keyboards, monitors and Solo portables) purchased and located in the continental United States, Alaska, Hawaii, Puerto Rico and Canada.

Let's talk about life on the technological edge.



How can you keep up with the speed of new technology? Easy. Buy from the company that gives you the hottest stuff out there. Our G6-400 won the Editor's Choice Award from the May '98

PC Magazine and our G-Series won the 1998 World Class Award from *PC World*. Not bad, but we also

pentium II just came out with the G6-450, featuring the fastest Pentium® II processor yet. Let us design a system personalized just for you. And with the Your:)WareSM program, you can ride the wave of innovation with the option of trading in your GatewayTM PC after two years toward the purchase of a new one.² We call it obsolescence protection. Another reason technology buffs keep coming back to Gateway.





The speed you need today (and in the future)

Every Gateway client is unique, and so is every Gateway PC. The systems here are just examples of what we can build for you.

Fast G6-400



Intel® Pentium II
Processor 400MHz
with 512K Cache

64MB SDRAM

EV700 .28 Screen Pitch
17" Monitor
(15.9" viewable)

8MB AGP
Graphics Accelerator

10GB Ultra ATA
Hard Drive

DVD-ROM Drive &
MPEG2 Decoder

SoundBlaster®
AudioPCI™ 64V

Boston Acoustics®
BA635™ Speakers

U.S. Robotics®
56K* Voice Winmodem

Mid-Tower Case

MultiFunction Keyboard
& MS® IntelliMouse®



Microsoft® Windows® 98
& MS Home Essentials™
Software



Gateway Gold™ Service**
for G-Series PCs



As low as
\$56/mo.
for 48 mos. or \$1999*

Scary G6-450



Intel Pentium II
Processor 450MHz
with 512K Cache

128MB SDRAM

VX900 .26 Screen Pitch
19" Monitor
(18" viewable)

8MB AGP
Graphics Accelerator

10GB Ultra ATA
Hard Drive

DVD-ROM Drive &
MPEG2 Decoder

SoundBlaster
AudioPCI 64V

Boston Acoustics
BA635 Speakers

U.S. Robotics
56K* Voice Winmodem

Mid-Tower Case

MultiFunction Keyboard
& MS IntelliMouse



Microsoft Windows 98
& MS Home
Essentials Software



Gateway Gold Service**
for G-Series PCs



As low as
\$69/mo.
for 48 mos. or \$2479*

Extra bells and whistles

All these add-ons
are available when
you purchase a
Gateway system.

Voodoo2™ Card with
Extreme Gaming
Software⁵ (\$249)

MS SideWinder®
Precision Pro
Joystick (\$59)

HP® ScanJet 5100Cse
Color Scanner (\$299)

Epson® PhotoPC™ 550
Color Digital Camera
(\$249)

Imomega® 100MB
Internal ZIP® Drive
(\$99)

HP 722Cse Color Ink
Jet Printer (\$299)

Add a Zip™ BUILT-IN drive for only \$99

The Capacity To Do More™ with your PC.
It's today's standard in high-capacity removal storage.
Exchange and carry your files anywhere.
Organize and protect more of your stuff.

gateway.netSM
\$14.95/mo.³

The Screamer



G6-450XL

Intel Pentium II Processor
450MHz with 512K Cache

128MB SDRAM

VX900 .26 Screen Pitch
19" Monitor (18" viewable)

8MB AGP Graphics
Accelerator

12MB 3Dfx™ Voodoo2
3-D Accelerator & Extreme
Gaming Software

TV/FM Tuner Card

16GB Ultra ATA
Hard Drive

DVD-ROM Drive &
MPEG2 Decoder

Philips CD-RW
CD-Rewritable Drive

SoundBlaster AudioPCI 64V

Boston Acoustics
MediaTheater™
3-Piece Speaker System

U.S. Robotics 56K* Voice
Winmodem

Tower Case

MultiFunction Keyboard &
MS IntelliMouse



Microsoft Windows 98 &
MS Choice Software



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As low as
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for 48 mos. or \$3449*

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Let's talk about home economics.



People who buy Gateway™ PCs for their home say they want a computer that does everything — including fit into their budget. We can do the same for you. Our G-Series was recently named **Best Home Desktop PC**, receiving the **World Class Award** from the July '98 *PC World*. The G6-400, in fact, was rated **WinList Fastest Performer** by the May to September '98 *Windows Magazine*. We'll take the system you choose and load it up with all the hardware and software your family needs. Including Internet access,³ and flexible service and support 24 hours a day, seven days a week. Plus, with the Your:}WareSM program,² you have the option of trading in your Gateway PC toward the purchase of a new one in two years. That's a home improvement anyone can make.





Get more bang for your buck

Every Gateway client is unique, and so is every Gateway PC. The systems here are just examples of what we can build for you.

Family Friend G6-333C

- Intel® Celeron™ Processor 333MHz with 128K Cache
- 32MB SDRAM
- EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- 4MB 3-D AGP Graphics
- 6.4GB Ultra ATA Hard Drive
- DVD-ROM Drive & MPEG2 Decoder
- SoundBlaster® AudioPCI™ 64V
- Boston Acoustics® BA635™ Speakers
- U.S. Robotics® 56K* Voice Winmodem
- Mid-Tower Case
- MultiFunction Keyboard & Mouse
- Canon® Color Printer
- Microsoft Windows® 98 & MS Home Essentials™ Software
- Gateway Gold™ Service™ for G-Series PCs*
- As low as **\$44/mo.** for 48 mos. or \$1568*

Extended Family G6-450

- Intel Pentium® II Processor 450MHz with 512K Cache
- 128MB SDRAM
- VX900 .26 Screen Pitch 19" Monitor (18" viewable)
- 8MB AGP Graphics Accelerator
- 10GB Ultra ATA Hard Drive
- DVD-ROM Drive & MPEG2 Decoder
- SoundBlaster AudioPCI 64V
- Boston Acoustics BA635 Speakers
- U.S. Robotics 56K* Voice Winmodem
- Mid-Tower Case
- MultiFunction Keyboard & MS IntelliMouse
- Microsoft Windows 98 & MS Home Essentials Software
- Gateway Gold Service™ for G-Series PCs
- As low as **\$69/mo.** for 48 mos. or \$2479*

Optional additions

All these add-ons are available when you purchase a Gateway system.

Finance Pack Software (\$69)

Family Reference Software (\$79)

Visioneer® PaperPort™ 6100 Scanner (\$179)

Iomega® 100MB Internal ZIP® Drive (\$99)

HP® 722Cse Color Ink Jet Printer (\$299)

Epson® PhotoPC™ 550 Color Digital Camera (\$249)

Voodoo2™ Card with Extreme Gaming Software (\$249)

Add a Zip® BUILT-IN drive for only \$99

The Capacity To Do More™ with your PC. It's today's standard in high-capacity removable storage. Exchange and carry your files anywhere. Organize and protect more of your stuff.

gateway.netSM
\$14.95/mo.³

The Dream Machine

G6-400

- Intel Pentium II Processor 400MHz with 512K Cache
- 64MB SDRAM
- EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)
- 8MB AGP Graphics Accelerator
- 10GB Ultra ATA Hard Drive
- DVD-ROM Drive & MPEG2 Decoder
- SoundBlaster AudioPCI 64V
- Boston Acoustics BA635 Speakers
- U.S. Robotics 56K* Voice Winmodem
- Mid-Tower Case
- MultiFunction Keyboard & MS IntelliMouse
- Microsoft Windows 98 & MS Home Essentials Software
- Gateway Gold Service™ for G-Series PCs
- As low as **\$56/mo.** for 48 mos. or \$1999*

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Let's talk about the ultimate traveling companion.



pentium® II

On the road again? We'll build you a portable with all the power and features of a desktop PC. So you can do spreadsheets, send e-mails, make presentations and more, to make you just as productive as back at the office. You can even play games and watch DVD movies to make traveling more fun. The Solo® 2500 and 9100 each won the August '98 *PC Magazine* Editor's Choice award, and the Solo 2500 won the magazine's Best Buy Award as well. With the best portables on the market, it's just one more reason customers who buy another computer come home to Gateway.





The latest thing in portables

Every Gateway client is unique, and so is every Gateway PC. The systems here are just examples of what we can build for you.

King of the Road Solo 5150LS



14.1" XGA TFT
Color Display

Intel® Pentium® II
Processor 233MHz
with 512K Cache

64MB SDRAM
(expandable to 160MB)

2.5MB 256-Bit
Graphics Accelerator

Modular DVD-ROM
Drive & 3.5" Disk Drive

4GB Ultra ATA
Hard Drive

Lithium Ion Battery
w/ Bty Gauge & AC Pack

2 USB Ports, CardBus
& Zoomed
Video Support

NTSC/PAL Video Output

Integrated 16-Bit Sound
& Stereo Speakers

TelePath® 56K* Modem
for Windows

Deluxe Leather Case

EZ Pad® Pointing Device



Microsoft® Windows® 98
& MS® Office 97,
Small Business Edition
plus Bookshelf® 98

LapLink® V.7.5 for
Windows 98 &
McAfee® VirusScan



Gateway Gold™ Service™
for Portable PCs



As low as

\$81/mo.

for 48 mos. or \$2899*



The Portable Desktop Solo 9100LS

14.1" XGA TFT
Color Display

Intel Pentium II
Processor 266MHz
with 512K Cache

64MB SDRAM
(expandable to 192MB)

4MB SGRAM 3-D
Graphics Accelerator

Modular DVD-ROM
Drive & 3.5" Disk Drive

6GB Ultra ATA
Hard Drive

Lithium Ion Battery &
AC Pack

2 USB Ports, CardBus &
Zoomed Video Support

NTSC/PAL Video Input &
Output

16-Bit Wavetable Sound
& Altec Lansing®
Speakers

TelePath 56K* Modem for
Windows

Deluxe Leather Case

EZ Pad Pointing Device



Microsoft Windows 98 &
MS Office 97, Small
Business Edition plus
Bookshelf 98

LapLink V.7.5 for
Windows 98 &
McAfee VirusScan



Gateway Gold Service™
for Portable PCs



As low as

\$95/mo.

for 48 mos. or \$3399*

Other goodies

All these add-ons
are available when
you purchase a
Gateway system.

Canon® BJC®-80 Color
Bubble Jet Printer
(\$299)

Kensington®
Saddlebag (\$79)

MS Professional
Resource Suite (\$99)

PC Card Modem with
Cellular Support
(\$50 upgrade from
Winmodem)

Kensington
Master Lock® (\$39)

gateway.netSM
\$14.95/mo.³

Frequent Flier



Solo 2500SE

12.1" TFT Color Display

Intel Pentium
Processor with MMX™
Technology 200MHz

32MB SDRAM
(expandable to 160MB)

2MB Graphics
Accelerator
w/ 64K Colors

Integrated 8X min/20X
max CD-ROM Drive &
3.5" Disk Drive

2GB Ultra ATA
Hard Drive

NiMH Battery & AC Pack

USB Ports, CardBus
& Zoomed Video Support

NTSC/PAL Video Output

Integrated 16-Bit Sound
& Stereo Speakers

TelePath 56K* Modem
for Windows

Casual Case

EZ Pad Pointing Device



Microsoft Windows 98
& MS Home Essentials™

LapLink V.7.5 for
Windows 98 &
McAfee VirusScan



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As low as

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Let's talk about your own way of doing business.



You run a tight ship. How do you keep up with the latest technology without buying equipment you don't need? With Gateway™ business-class computers. Gateway was named one of the top two **Best Computer Mail-Order Companies** by July '98 *PC World*. And the GP6-450 **pentium® II** features the fastest Pentium® II processor yet. We'll upgrade your office with computers that are customized with the hardware, software and networking components you need. At an affordable price. And with free 24/7 technical support that lasts for as long as you own your system. That's why small companies are big fans of Gateway.





PCs with your name on them

Every Gateway client is unique, and so is every Gateway PC. The systems here are just examples of what we can build for your business.

The Associate GP6-333C

- Intel® Celeron™ Processor 333MHz with 128K Cache
 - 64MB SDRAM
 - EV500 .28 Screen Pitch 15" Monitor (13.9" viewable)
 - 4MB AGP Graphics Accelerator
 - 6.4GB Ultra ATA Hard Drive
 - 13X min/32X max CD-ROM Drive
 - Mid-Tower Case
 - 104+ Keyboard & MS® IntelliMouse®
 - Microsoft Windows® 98 & MS Office 97, Small Business Edition plus Bookshelf® 98
 - Gateway Gold™ Service™ for GP-Series PCs
 - GoldValue Lease
- \$46/mo.**
for 36 mos. or **\$1299***

The Partner GP6-350

- Intel Pentium II Processor 350MHz with 512K Cache
 - 64MB SDRAM
 - EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)
 - 8MB ATI SDRAM AGP Graphics Accelerator
 - 10GB Ultra ATA Hard Drive
 - 13X min/32X max CD-ROM Drive
 - Mid-Tower Case
 - 104+ Keyboard & MS IntelliMouse
 - 10/100 Ethernet Network Card
 - Microsoft Windows 98 & MS Office 97, Small Business Edition plus Bookshelf 98
 - Gateway Gold Service™ for GP-Series PCs
 - GoldValue Lease
- \$66/mo.**
for 36 mos. or **\$1849***

More possibilities

All these add-ons are available when you purchase a Gateway system.

HP® OfficeJet 600 MultiFunction Printer (\$499)

Quickbooks® Pro Software (\$219)

Iomega® 100MB Internal ZIP® Drive (\$99)

Iomega ZIP Disks 10 Pack (\$149)

APC® Back-UPS® 650s Uninterruptible Power Supply (\$299)

HP LaserJet 4000se Laser Printer (\$1149)

3Com® PCI 10/100 TP Network Card (\$64)

Add a Zip® BUILT-IN drive for only \$99.

The Capacity to Do More™ with your PC. It's today's standard in high-capacity removable storage. Exceeds and carries you there. Enhance and protect more of your stuff.

The Office Star

GP6-450

- Intel Pentium II Processor 450MHz with 512K Cache
 - 128MB SDRAM
 - VX900 .26 Screen Pitch 19" Monitor (18" viewable)
 - 8MB AGP Graphics Accelerator
 - 13GB Ultra ATA Hard Drive
 - 13X min/32X max CD-ROM Drive
 - Mid-Tower Case
 - 10/100 Ethernet Network Card
 - 104+ Keyboard & MS IntelliMouse
 - Microsoft Windows 98 & MS Office 97, Small Business Edition plus Bookshelf 98
 - Gateway Gold Service™ for GP-Series PCs
 - GoldValue Lease
- \$92/mo.**
for 36 mos. or **\$2599***

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Let's talk about your


Gateway™

*Leasing provided by independent leasing companies to qualified commercial customers. Lease payments based on 36-month term. Lease terms subject to change without notice or obligation. **Gateway Gold on-site and installation services are administered by PC Technology Services, Inc. for product (excluding mice, keyboards, monitors and Solo portables) purchased and located in the continental United States, Alaska, Hawaii, Puerto Rico and Canada.

Let's talk about working on a presentation at 3 a.m. with technical support standing by.



Businesses stick with Gateway because we stick with them. We give your company free 24/7 service and support that lasts for as long as you own your systems. And no matter what size your business is, we'll provide customized solutions complete with hardware, software, and peripherals, all at affordable prices. It's no surprise that the August '98 *Small Business Computing* ranked Gateway one of the top three technology vendors for small business. Let's talk about what we can do for yours.





The easy-to-manage network

Why adapt to off-the-shelf solutions when Gateway will custom-build PCs and servers just for your business?

The Heavy Hitter E-4200 400

Intel® Pentium® II Processor
400MHz with 512K
ECC Cache

128MB 100MHz SDRAM

VX900 .26 Screen Pitch
19" Monitor (18" viewable)

ATI RAGE PRO TURBO™
2X AGP w/ 8MB

8.4GB SMART II Ultra ATA
Hard Drive

13X min/32X max
CD-ROM Drive

3Com® 10/100 Ethernet
Adapter

Mid-Tower Case

104+ Keyboard & MS®
IntelliMouse®

MS Windows® 95
DMI 2.0 Compliant
Intel LANDesk®
Client Manager 3.1

Gateway Gold™ Service™
for E-Series PCs

GoldValue Lease

\$85/mo.

for 36 mos. or **\$2399***

The Traveler Solo® 2500LS

12.1" TFT Color Display

Intel Pentium II
Processor 233MHz

32MB SDRAM
(expandable to 160MB)

2MB Graphics Accelerator
with 64K Colors

Integrated DVD-ROM Drive

3.5" Disk Drive

4GB Hard Drive

Lithium Ion Battery &
AC Pack

USB Ports, CardBus &
Zoomed Video Support

NTSC/PAL Video Output

Integrated 16-Bit Sound &
Stereo Speakers

TelePath® 56K* Modem
for Windows

EZ Pad® Pointing Device

Microsoft® Windows 98

Microsoft Office 97, small
Business Edition plus
Bookshelf® 98

LapLink® for Windows 95 &
McAfee® Virus Scan

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Trends Peripherals

IDE RAID SOLUTIONS

Built-in, Nonstop Backup

If you run a small business and store sensitive data on your PC or server, you need to back up frequently to protect against disk failure or other catastrophic data loss. The questions traditionally have been, how frequently should you back up and what backup medium should you use? Though tape is cheap, it's also time-consuming. And like other removable media, it can require a separate operation that either runs in the background or makes you temporarily shut down your system.

Now, thanks to new solutions from Arco Computer Products (954-925-2688, www.arcoide.com) and Promise Technology (800-888-0245, www.promise.com), you can build backup functions into every write-operation to your hard disk. The idea comes from the world of networking, and is known as RAID mirroring (or RAID 1).

When most people think of RAID, they think of the high-bandwidth SCSI interface which has typically been required for complex data management. But the newest products bring RAID to your PC's standard IDE bus—without a performance hit.

Arco's **DupliDisk**, one of the simplest solutions, is mountable in either an ISA slot (\$215 list), a

PCI slot (\$225), or a 3.5-inch drive bay (\$245). To install it, just mount the card and attach the bundled cable to your motherboard's primary IDE channel. Then attach two hard disks to the card. From this point on, every write-to-disk operation will write identically to both disks. If one disk fails, the system will alert you

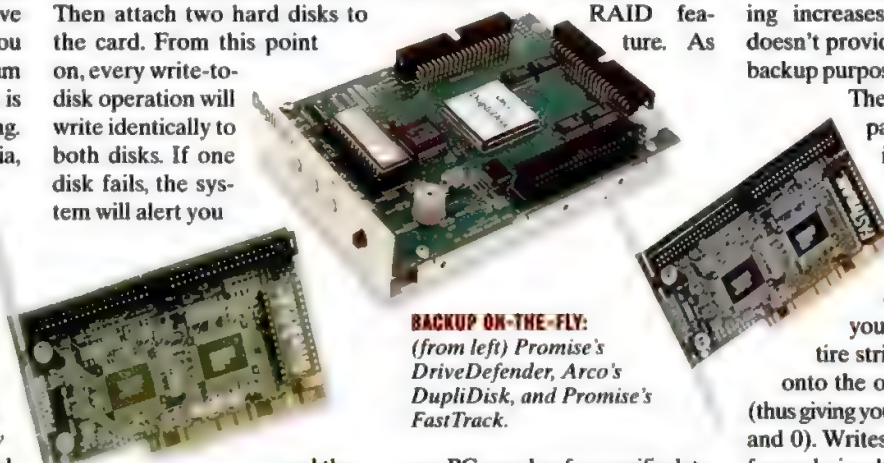
and then continue working with the other disk.

Installing and maintaining the DupliDisk requires no software drivers. Just install the card and your new hard disks, then reboot your computer with the Arco ACP disk in the floppy disk drive. A menu-driven, DOS-based application will appear to help you select the correct IDE channel and choose which disk will serve as the read disk.

Arco's main competitor, Promise Technology, makes several add-in boards that bring SCSI ca-

pabilities to the IDE channel. Directly competing with the DupliDisk is Promise's **DriveDefender** PCI card (\$99 list). Unlike the DupliDisk, the DriveDefender incorporates two IDE ports on the card itself, potentially supporting up to four hard disks.

Its main added feature is *load-balancing*, a traditional SCSI RAID feature. As



BACKUP ON-THE-FLY: (from left) Promise's DriveDefender, Arco's DupliDisk, and Promise's FastTrack.

your PC searches for specific data, the card's firmware determines which of the hard disks has its read-head closer to that data's physical location; it then retrieves the data from that disk. This keeps both disks working at the same time and doubles the sustained transfer rate for data reads.

In addition to the DriveDe-

fender, Promise also sells the **FastTrack** (\$149 list), a PCI solution similar to the Drive Defender but capable of RAID 0 striping as well as RAID 1 mirroring. *Striping* is a speed-enhancing technique that spreads data over multiple drives at one time, making all appear as one large drive in Windows Explorer. Though striping increases performance, it doesn't provide redundancy for backup purposes.

The FastTrack is expandable, thanks to its two on-board IDE channels. And if you have room for two more hard disks in your PC, you can mirror the entire striped configuration onto the other IDE channel (thus giving yourself both RAID 1 and 0). Writes will then be performed simultaneously to both IDE channels, each of which consists of two striped drives. If you really want to go over the top, you can install two FastTrack cards, each with four striped disks, with one entire card mirroring the other one. Of course, you'll need a lot of room for all those hard disks.—Josh Levy

Taking IDE Out of the Box

If your PC is filling up with peripherals and you need to expand your IDE bus, take a look at the new **HotPort** solutions from GSI Technology (800-486-7800, www.gsi-inc.com). Consisting of an ISA expansion card, an external box that can carry one or more IDE peripherals, and a series of quick-connect cables, HotPort provides an inexpensive way to give your PC some breathing room. It's a clever way to add a new hard disk, a CD-R drive, or anything in between.



Installation is easy and involves no software drivers. First, plug the HotAdapter card into an ISA slot. Then, attach a PC power supply cord and the cord from your sound card to the HotAdapter. Finally, use the HotLink cable to connect the card to the HotBox (the external container that carries the extra peripherals in standard 5.25-inch bays). Now, just reboot the computer, and you're ready to go.

The **Single-Drive HotPort Kit** (\$139 list) bundles a HotAdapter card that supports up to four external IDE peripherals with a HotBox that holds one. The **HotTower** (about \$250) sells without the card but supports four bays. The **HotAdapter** alone costs \$59.—JL

SCANNERS

Text on the Go

In this issue, we review 25 color flatbed scanners for home and office (see "What's Now...What's Next"), but what if you need to scan and save documents when you're away from your desktop?

Hewlett-Packard (800-722-6538, www.capshare.hp.com) has a solution: the **HP CapShare 910** (\$699 list). About the size of a portable audio CD player and weighing just 12.5 ounces, the battery-powered "information appli-

cance" lets you store up to 50 letter-size pages of information. Simply swipe the scanning end across the document you want to save—a contract, news article, or business card—and the unit captures the image and displays a thumbnail view on the built-in LCD screen.

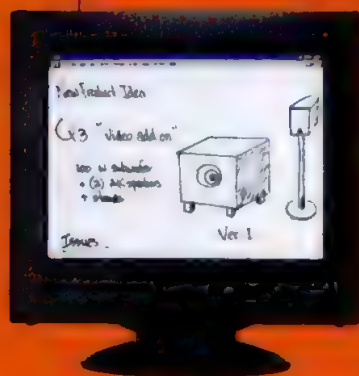
The CapShare's infrared port lets you transmit the stored data wirelessly to an IrDA-enabled printer, laptop, or hand-held organizer. Documents are stored in Adobe Acrobat (PDF) format, which is supported by most OCR programs.—Jamie M. Bsaies



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APPLICATION SERVERS

Battle for the Middle Tier

Application servers emerged years ago to address the problems associated with maintaining network performance and the development of efficient applications to run on the server end of the client-server equation. This middle tier of network applications has become one of the most competitive and fastest-moving areas of all computing, as intranets have made development of distributed applications more important. All of the big players in client-server computing have entered this market, and an assortment of standards are emerging.

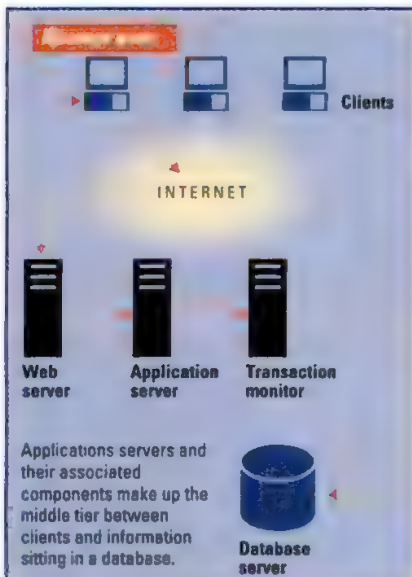
These products consist of a variety of functions performed on servers: a Web server, a transaction server, an object request broker (ORB), database access middleware, messaging-oriented middleware, and a variety of other network services, such as directory and security services.

The need for Web servers in the enterprise is clear: Intranets make development of distributed applications easier and programs more accessible. Transaction servers let developers define a series of operations—among other tasks—and then ensure that if any of the individual functions fail to complete successfully, all of the functions are “rolled back” and do not occur.

Object request brokers (ORBs) create a system- and network-level infrastructure for defining objects that can interact with each other. There are two main competing standards these days: Microsoft's COM/DCOM and CORBA/IIOP, which is supported by much of the rest of the industry. Database-access middleware provides a variety of programming interfaces for programs on the middle tier to

work with the database server (the bottom tier). Messaging middleware lets objects communicate with each other over high-latency connections.

Microsoft Corp.'s (800-426-9400, www.microsoft.com) prod-



ucts in this space are a group of Windows NT-based services, including the **Microsoft Internet Information Server**, **Microsoft Transaction Server**, **Microsoft Message Queue Server**, and **Windows DNA**, as well as several other services that come with Windows NT Server 4.0 (such as the built-in Distributed Component Object Model and security manager). IIS, MTS, and MSMQ are free downloads for Windows NT Server licensees, and they're automatically included with NT Server purchases.

The **Netscape Application Server 3.0** (650-937-2555, www.netscape.com/appserver/v2.1/index.html), which should be available by the end of the year, focuses on high availability and reliability. Based on products by Kiva Software Corp., a company Netscape purchased last year, NAS includes the Netscape Application Builder for writing business logic in Java and C/C++, and

the IONA ORB for CORBA/IIOP interoperability. The Netscape Extension Builder, used for defining server-side extensions to legacy and other external systems, is sold separately.

Oracle Corporation (800-672-2531, www.oracle.com/products/asd/asdhome.html) recently released **Oracle Application Server 4.0**, which includes a full CORBA 2.0 ORB, transaction monitor capabilities, and database middleware, all built by Oracle. A copy of Spyglass' Web server is included, but the Application Server integrates with both Netscape Enterprise Server and Microsoft's IIS. By the end of the year, Oracle's product will offer full support for a series of Java-based middleware standards, called Enterprise JavaBeans (EJB). At its announcement this past spring, numerous vendors, including IBM and many small companies, promised support for EJB.

Even though the specs are

still shaky and no interoperability testing exists, WebLogic (415-659-2600, www.weblogic.com) is claiming EJB support in its **Tongah Java Application Server 3.1**. WebLogic also provides support for Microsoft's COM, allowing users to integrate with Microsoft's server software and development tools.

Lastly, Inprise Corp. (408-431-1000, www.inprise.com), formerly known as Borland, has announced the planned delivery of the **Inprise Application Server** later this year. Inprise has many years of experience with database middleware, and last year solidified its position with the acquisition of Visigenic Software and its **VisiBroker CORBA ORB**. VisiBroker now supports transactions as well, and Inprise promises to add EJB support. Inprise's experience in development tools, especially Java, should help the company as it expands in this market.—Larry Selzer

BROWSER UTILITIES

Recover Your Space

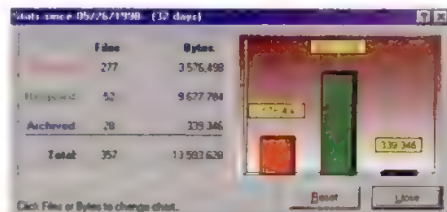
A downside to Web surfing is the inevitable buildup of lots of unnecessary files on your hard disk. Though browsers have some built-in tools to limit these temporary files, you might want to take a more proactive tactic with a third-party cleanup utility.

Waste Whacker 3.02 (\$19.95 list) from Doesn't Byte Software (888-819-9837, www.dbytes.com), is a utility that automates removing unwanted files from your hard disk. It targets temporary and backup files, files with zero-byte size, and cache files.

Whacker's wizard lets you define search parameters such as file types, source, age, and size. The program scans your disk and issues a report in a Windows Explorer-style interface. Unwanted files can be sent to the Recycle bin for deletion or compression.

Besides regaining real estate on your hard disk, **WebSweep 1.0**, from Luckman Interactive (213-614-0966, armitage.luckman.com/products/websweep), works as a security tool by erasing traces of previous browsing sessions.

WebSweep (\$19.95 list) cleans up such browsing elements as Active-X, HTML, video, audio, browser history lists, cached files,



TRASH IT: Waste Whacker shows where it moves unwanted Internet files.

and other temporary and compressed files. WebSweep can operate in either an automatic or interactive mode, and its program wizard lets you remove files without having to mark individual files.—Doug Beizer

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Trends Networking

NETWORKING KITS

The Wireless Home

Home networking continues to gain momentum as PC prices drop and more homes have multiple systems. Most people want the benefits of networking (file sharing, gaming, shared Internet access) but don't want the hassle and expense of stringing wire through

RECAP PC Magazine tested 13 networking kits in our issue of September 1, 1998. The NetGear Network Starter Kit SB 104 won our Editors' Choice.

their houses. Wireless alternatives have always existed, but they've been priced so only mid-size businesses could afford them.

That's changing with a new wave of wireless networks from

Diamond Multimedia (800-468-5846, www.diamondmm.com) and WebGear (408-271-9888, www.webgear.com) that cost around \$100 per networked PC.

Diamond's **HomeFree** networks desktop and laptop PCs using 2.4 GHz radio frequency (RF) signals. The signals can carry distances up to 150 feet and deliver data at up to 1 Mbps. The RF signals are unaffected by floors, ceilings, or walls, and HomeFree uses frequency hopping to further reduce interference. As with most kits, HomeFree utilizes Windows built-in Peer-to-Peer networking to share files and programs, but Diamond also includes software so you can share

your Internet connection.

HomeFree can connect any Windows 95 or 98 desktop PC with an open ISA or PCI slot and any laptop with a PC Card. The HomeFree Desktop Pac includes one ISA and one PCI card (\$199.95 list). The Combo Pac (\$229.95 list) includes one ISA card and a PC Card; also available are additional PCI or ISA cards (\$99.95 list, each) and PC Cards (\$129.95 list).

WebGear updates its wireless network kit while dropping the price. The **Aviator Wireless Network 22** (\$169.99 list) works out to only \$85 per computer and improves upon the Aviator control software.

The Aviator can network any Windows 95/98 PCs or laptops with a parallel port. Each unit

plugs into a parallel port; the new software lets you unplug the Aviator on the fly so you can



share the port with printers or other devices. RF signals transmit data at speeds up to 500 Kbps at a distance of up to 75 feet. The Aviator uses Windows' Peer-to-Peer networking for file sharing; proxy server software is included to share an Internet connection.—*Michael N. Rusignuolo*

INTERNET ACCESS

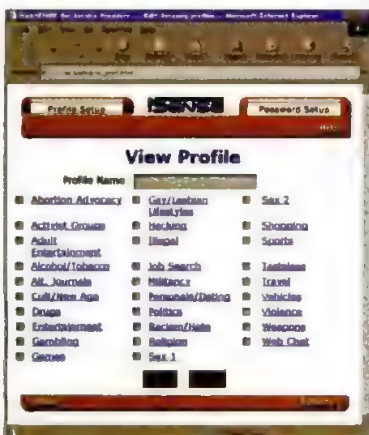
New Approaches to Blocking

In a saturated ISP marketplace, you can get most basic ISP services at about the same price anywhere you turn. Value-added services are a means for ISPs to differentiate themselves to potential customers, and companies are

ware on their PCs if they're clever enough. NetPartners (800-723-1166, www.netpart.com) offers a new approach with **WebSense for Home**, which allows ISPs to provide Internet access for children filtered at the ISP level instead of at the child's PC.

WebSense for Home runs on the ISP's Windows NT or Unix server and integrates with the ISP's Network Access Server (NAS). The end user sees no difference from a regular, unfiltered account. But when a filtered account accesses the ISP, the NAS simply redirects all information through the WebSense server.

The server checks the user's requests against its filtering profile and allows or denies access accordingly. The parent in charge of the filtered account uses a checkbox administration menu



ISP EXTRAS: WebSense for Home offers filtering at the ISP level.

stepping up to the plate to provide ISPs with new capabilities.

The problem with Internet filtering programs is that your children can get around client soft-

ware similar to the one in the client-side WebSense product to set that profile. WebSense for Home will be available by the end of the year; pricing has yet to be finalized.

Security vendor WatchGuard brings the antivirus update model to firewall security with **Managed Security Services (MSS)**. MSS's Global Policy Manager lets an ISP remotely manage, update, and log security devices for its customers. WatchGuard Event Processors (WEPS) can create management subgroups so you can set standard policies for different groupings.

The LiveUpdate technology necessary for MSS premiers in

WatchGuard's Firebox II turnkey security appliance. The complete configuration is stored in flash memory; an entire new configuration can be downloaded over the Internet. ISPs using Firebox II devices can thereby remotely update their clients with new security patches and capabilities as they come out, just as antivirus companies do with virus updates. Pricing for MSS is a flat rate on a per-customer basis.—*MNR*

Solutionware

If you're implementing a mission-critical service for your enterprise, the path can be a long and costly one. Compaq Corp. (800-345-1518, www.compaq.com/activeanswers) smooths this process with **activeAnswers** (\$1,695 list), a subscription-based extranet for Compaq customers, systems integrators, VARs, and Web developers.

The unique site offers a library of **solutionware**—a combination of program tools, information, and methodologies based on years of experience with leading software vendors. activeAnswers also offers personalized site access, an online community that links suppliers and users, and online help. The solutionware library offers "volumes" on SAP R/3, Web solutions, e-commerce, Microsoft Exchange, and Oracle Data Mart and plans additional volumes in collaboration with such companies as Baan, Citrix, Lotus, Microsoft, and Novell.—*Carol A. Mangis*



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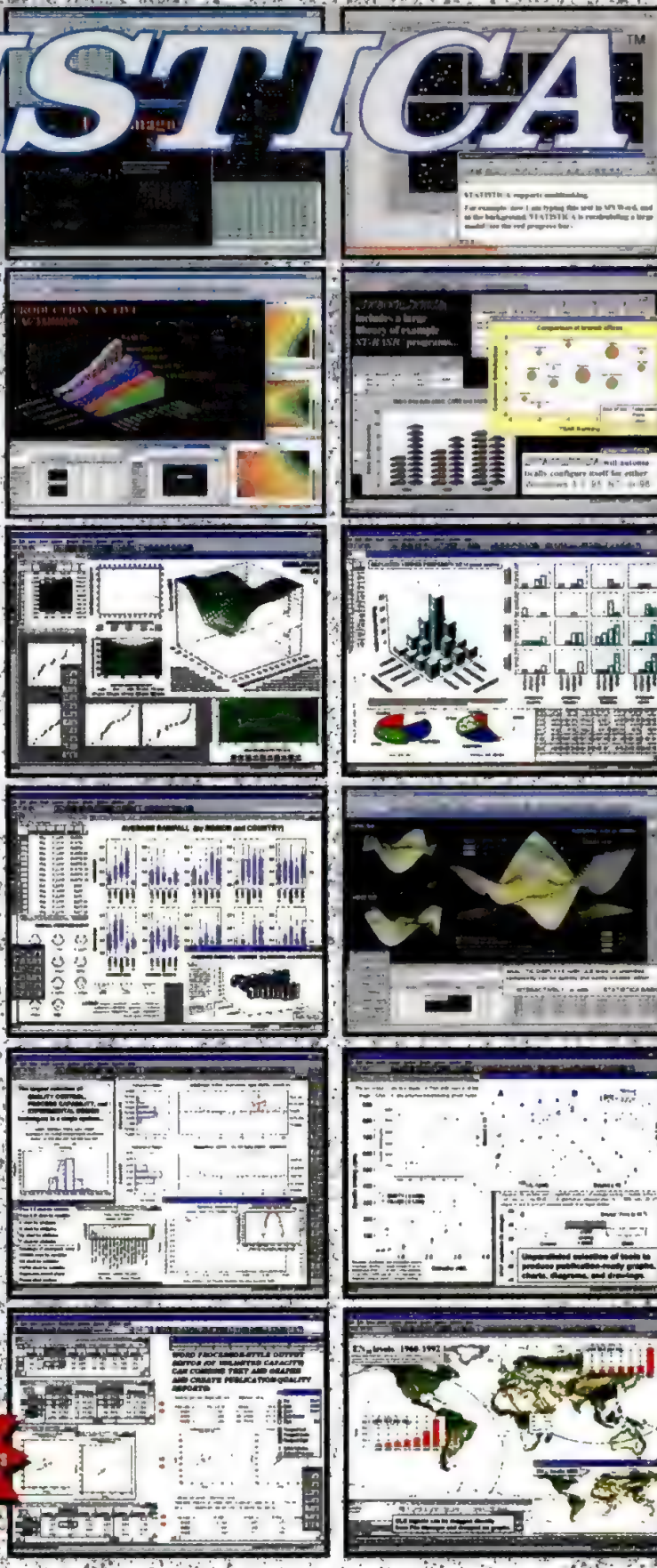
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First Looks



Celeron Caches Up

Intel's Celeron processor for low-cost PCs gets a big performance boost from 128K of integrated L2 cache. PC Magazine Labs tests four 333-MHz Celeron systems.

By Carol Venezia

Since the 386SX, there's been no Intel-branded processor that's gotten more notoriety than Celeron. When the first performance results arrived, the numbers told the story: The 266-MHz Celeron without L2 cache actually ran slower than a same-speed Pentium MMX chip with L2 cache. Well, guess what?

Those days are over: It's get-even time for Celeron.

On August 24, Intel announced the newest members of the Celeron family (perhaps better known by their code name, Mendocino), the 300A and the 333—both touting 128K of integrated L2 cache. The latter, as you'd expect, runs at 333 MHz. For the former, Intel added A to distinguish this chip from the preexisting 300-MHz cacheless Celeron.

You might think that 128K of L2 cache couldn't possibly

amount to much in terms of performance. But according to our benchmark tests, it does. Comparing Celeron computers with systems tested in our recent roundup of low-cost PCs ("Sub-\$1,000 PCs: We Test 37," September 1, 1998), we found that the new 333-MHz Celeron can outperform a 300-MHz Pentium II. Yes, that's *Pentium II*.

THE DIFFERENCE IS IN THE CHIP

So what's different? Well, this new Celeron is built on the same 0.25-micron CMOS process as its cacheless kin, it's mounted on the same type of circuit board (called a *single-edge processor package*, or SEPP), and it plugs into a 242-contact connector, just like previous Celerons and the Pentium II. To find the difference in the new Celeron, however, you have to look *inside* the chip itself.

Unlike the Pentium II—

whose L2 cache chips are separate entities mounted on the substrate on either side of the CPU—the new Celeron has its cache actually built into the processor die. Compared with the cacheless Celeron, it's about 20 percent larger: 153.9 versus 130.9 square millimeters in area. The addition of cache also has created a rise in the number of transistors, from 7.5 million to 19 million.

It's not just the presence of the cache that accounts for the performance boost, however; it's the speed at which the processor interacts with the cache. Because this L2 cache is integrated, the cache runs at full processor speed.

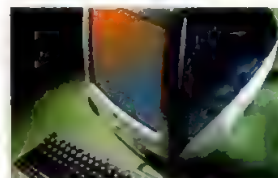
PERFORMANCE: BETTER THAN WITH THE PENTIUM II?

We were pleasantly surprised by the benchmark test scores achieved by the four 333-MHz Celeron PCs in this roundup:

INSIDE

STYLE OR SUBSTANCE?

PC Labs finds out whether the Apple iMac really is faster than a 400-MHz Pentium II. *Page 56.*



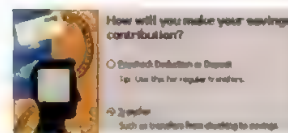
FETCH:

The new REX PRO PC Card Organizer adds data entry and more memory to this credit card-size PIM. *Page 60.*



CHECKS AND BALANCES:

Microsoft Money 99 provides some stiff competition for Quicken 99. *Page 60.*



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First Looks Online

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First Looks

the Compaq Deskpro EP C333/6400/CDS, the Dell Dimension V333c, the HP Brio 7100 Series, and the Micron Millennia C333. The four machines—each with Windows 98 and 64MB of RAM—posted ZD Business Winstone 98 scores that were, on the average, 56 percent better than those of the average Celeron/266, 35 percent better than those of a Pentium II/266, and even 7 percent better than those of a Pentium II/300.

It's important to note that the averages mentioned above are figured from our recent value-PC story (September 1, 1998). Those machines were all tested with Windows 95 and 32MB of RAM, but we've proved through past testing that our Winstone tests are only negligibly affected by this difference in operating system and this difference in memory. We compare these scores here to show that for approximately the same amount of money, you'll get much better performance with a Celeron/333 PC.

We also saw some great performance on our ZD 3D WinMark 98 tests. On the average (again, compared with machines from our value-PC story), these new Celerons performed 81 percent better than the average Celeron/266, 45 percent better than a PII/266, and 68 percent better than a PII/300. Obviously, the graphics board used in each PC has quite a bit to do with the 3D WinMark score. But the important point to remember,

once again, is that Celeron/333 delivers a great amount of bang for your bucks.

THE ROUNDUP

Speaking of bang for the buck, you're probably wondering exactly what you get inside these machines. Hard disk sizes range from 3.2GB to 6.4GB, while graphics accelerators are all over the board—from a 2MB integrated solution with very little 3-D support in hardware to a 16MB AGP board that racked up a Pentium II/400-like 3D WinMark score. Pricing (with a 17-inch monitor) ranges from just a bit more than \$1,400 to nearly \$1,900.

All four machines are aiming at approximately the same target audience: cost-conscious small-business or single users. It's important to note, however, that the Compaq and HP systems both aim more squarely at business-type customers: Both are DMI 2.0- and Wired for Management-compliant, and both shipped to us with Fast Ethernet adapters instead of modems (although both companies offer 56.6-Kbps modem options).

But the bottom line is that all four vendors expect to sell these machines to value-conscious customers who don't expect yesterday's technology just because

they choose to spend less. Value, in this equation, means the best combination of price, performance, and features. And you'll find it in spades in our Editors' Choice, the Dell Dimension V333c.

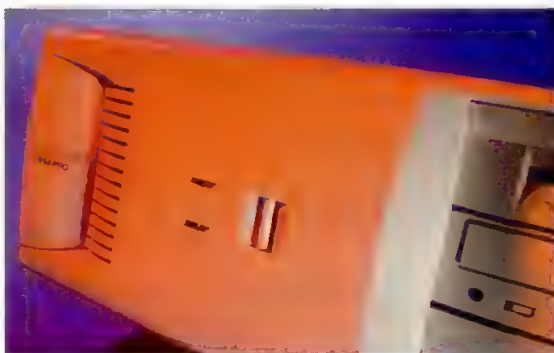
Compaq Computer Corp.

Compaq Deskpro EP C333/6400/CDS

Can't decide whether you want a desktop or a mini-tower PC? With the Compaq Deskpro EP

tency-of-platform features built into Compaq's Deskpro EN enterprise-class PCs—but you still want standards compliance, baseline manageability, and lots of hardware for your dollar—the Deskpro EP may be the machine for you. For those who really value flexibility, the Deskpro EP's \$1,850 street price—\$300 more than that of its next-closest competitor—may be worthwhile.

The Deskpro EP's flexible chassis design is unique in this roundup. The system came to us configured as an unassuming desktop, equipped with both a 32X CD-ROM drive and a floppy disk drive loaded up front plus one empty bay for future expandability. But in about 5 minutes, you can turn this machine into a mini-tower.



Compaq Deskpro EP C333/6400/CDS

Street price: With 64MB RAM, 6.4GB hard disk, 32X CD-ROM drive, Compaq Fast Ethernet 10/100 adapter, 17-inch monitor, \$1,850

Compaq Computer Corp., Houston; 800-888-0220, 281-370-0670
www.compaq.com

C333/6400/CDS you don't have to, for this machine cleverly can be either. If you're a business customer who doesn't need all of the manageability and consis-

All you have to do is stand the machine up, take off the side panel (after removing two screws), take off the front panel, rotate the front-accessible drives 90 degrees, and put the panels back on; voilà, you have a mini-tower. The drive-rotation task is simple: The cabling is labeled and the bays are numbered, so you'll know what goes where, and each drive easily slides out of the front of the case without removal of any screws. This entire process takes about 5 minutes.

BENCHMARK TESTS

333-MHz Celeron PCs

denotes Editors' Choice
Bold type denotes first place.

	ZD Business Winstone 98 Score	ZD 3D WinMark 98 Score	ZD Business Graphics WinMark 98 Score	ZD Business Disk WinMark 98 Thousands of bytes per second
Compaq Deskpro EP C333/6400/CDS	25.1	716	184	1,435
Dell Dimension V333c	24.2	751	153	1,445
HP Brio 7100 Series	24.3	56	149	1,485
Micron Millennia C333	23.7	664	160	1,460
Micron Millennia C333 (32MB RAM) ¹	21.8	662	157	1,460
Average Celeron/266 ²	15.6	302	N/A	N/A
Average Pentium II/266 ²	18.0	378	N/A	N/A
Average Pentium II/300 ²	22.7	326	N/A	N/A

(1) Reported for comparison. (2) "Sub-\$1,000 PCs We Test 37," PC Magazine September 1, 1998. N/A—Not applicable. We did not run these tests on this type of PC.

Editors' Choice

• Dell Dimension V333c



If Intel's new 333-MHz Celeron processor stands for anything, it's value—in terms of price, of course,

but also in terms of system features and performance as well. And none of the systems here deliver on this promise as well as our

Editors' Choice in this roundup, the Dell Dimension V333c (\$1,549 direct).

This machine proves that a PC that's loaded with compelling and useful hardware and software doesn't have to cost \$3,000. Inside you'll find a 6.4GB hard disk, 64MB of SDRAM, and a 56.6-Kbps ISA modem. Also—and perhaps more important—this machine has more expansion and upgradability options than any other system in this roundup. When you add a software bundle with enough variety to keep the whole family happy and a three-year warranty, you have an excellent all-around buy.

Inside the case, you'll find slot-expansion options that outrank the competition's. In addition to an AGP slot for the machine's 16MB STB Velocity 4400 graphics board, there are two PCI slots, one shared slot, and two ISA slots. In our test machine, one PCI slot was taken by a Compaq Fast Ethernet 10/100 adapter with Wake on LAN support, while one ISA slot held a Compaq Premier Sound audio card with external jacks for headphones, microphone, and speakers. The only thing missing was a MIDI port, but in view of the machine's business bent, this wasn't surprising. The Deskpro EP's inter-

rior is clean, open, and accessible, so adding options down the road should be easy.

The system's Celeron processor is complemented by Intel's EX chip set and thus supports two DIMM sockets. On our benchmark tests, the Deskpro EP performed well, posting the top score on both Winstone and ZD Business Graphics WinMark 98. On the 3D WinMark measure, the unit posted an impressive score of 716, second only to the Dell Dimension's score.

The Deskpro EP runs quite light on software, because Compaq preloads only its Insight Manager, a desktop-manage-

ment package. But you do get the Compaq Restore CD, a bootable CD that will restore the machine to the original configuration if needed.

The Deskpro EP is backed by a three-year warranty. It may be a bit pricey, but it's flexible, fast, and expandable.

Dell Computer Corp.

Dell Dimension V333c



Back with yet another PC with a leading price/performance ratio is Dell Computer Corp., with its Dell Dimension V333c (\$1,549 direct). This machine—our Editors' Choice in this roundup—marks the introduction of the Celeron processor into the Dimension family. And what a debut it is! If you want the most value for your dollar and great performance to boot, this is the Celeron PC for you.

This Dimension proves that inexpensive doesn't have to mean poorly outfitted. First, the system offers more expandability and upgrade options than its competitors. The unit's mini-tower case has four empty drive bays (two front-accessible bays were taken by the floppy disk drive and 32X CD-ROM drive in our test machine) as well as two free PCI slots and one open shared expansion slot. Perhaps more important, the Dimension uses Intel's BX chip set, unlike the others here, which all use the EX chip

set. The BX supports both a 100-MHz front-side bus and up to three DIMM sockets, so if you ever decide to upgrade to a Pentium II processor, you can do so without sacrificing any features.

The rest of the Dimension's hardware features are equally impressive. In addition to a 6.4GB hard disk, there's a 56.6-Kbps ISA modem, integrated Yamaha sound, Harmon Kardon 195 speakers, and a MIDI port in the back for the gamers in the house. The only drawback



Dell Dimension V333c

Direct price: With 64MB RAM, 6.4GB hard disk, 32X CD-ROM drive, 56.6-Kbps ISA modem, 17-inch monitor, \$1,549

Dell Computer Corp., Round Rock, TX;

800-999-3355, 512-338-4400

www.dell.com

401 at www.pcmag.com/infolink

(a slight one in view of the expansion space mentioned above) is that in our test configuration, there was only one free IRQ.

The Dimension performed well on our benchmark tests, posting a Winstone score less than a point behind that of the leader, Compaq's Deskpro EP. On our 3D WinMark tests the Dimension topped the charts, aided by its integrated ATI Rage Pro Turbo AGP graphics accelerator with 8MB of memory.

Dell complements the Dimension with a big software bundle that has something for just about every member of the family. Preloaded is Microsoft's

SUMMARY OF FEATURES

333-MHz Celeron PCs

	System price (with 17-inch monitor, 64MB RAM)	Hard disk	Graphics adapter/RAM	CD-ROM drive speed	Modem or network adapter
denotes Editors' Choice					
Compaq Deskpro EP C333/6400/CDS	\$1,850 street	6.4GB Ultra ATA	STB Velocity 4400 AGP / 16MB	32X	Compaq Fast Ethernet 10/100 adapter
Dell Dimension V333c	\$1,549 direct	6.4GB Ultra ATA	Integrated ATI Rage Pro Turbo AGP / 8MB	32X	56K ISA modem (V.90, x2)
HP Brio 7100 Series	\$1,510 street	3.2GB Ultra ATA	Integrated Matrox G-100 AGP / 2MB	32X	HP 10/100 Fast Ethernet Adapter
Micron Millennia C333	\$1,410 direct	4.3GB Ultra ATA	Integrated nVidia Riva 128 / 4MB	32X	56K ISA modem (V.90, x2)

First Looks

Home Essentials pack, which includes Encarta 98, Greetings Workshop, Money 98, Photo Editor, and Works. Microsoft Office 97 Small Business Edition can be substituted at no extra cost, if you choose.

Getting it all without paying a fortune is easy: Just pick a Dimension.

Hewlett-Packard Co.

HP Brio 7100 Series

For small businesses with little or no IS support or for large corporations that need standards-compliant PCs but not necessarily lots of high-flying manageability features, HP offers its HP Brio 7100 Series (\$1,510 street).



HP Brio 7100 Series

Street price: With 64MB RAM, 3.2GB hard disk, 32X CD-ROM drive,

HP 10/100 Fast Ethernet Adapter, 17-inch monitor, \$1,510

Hewlett-Packard Co., Palo Alto, CA;
800-322-4772, 415-857-1501

www.hp.com

402 at www.pcmag.com/infolink

The system's price may seem a bit high if you compare the hardware bundle with others here. But to do that would miss the point of this machine, which really shines in the software and ease-of-use categories.

The Brio's most compelling feature is its software bundle, starting with HP Brio Center. Double-click on this icon and

you'll be taken to a screen that gives you three options—Find Information, Fix Problems, and Communicate and Share.

Find Information is the Brio's online reference guide, which gives you instructions on how to upgrade your PC as well as a guided tour of Windows, among other features. Fix Problems does exactly that: There's diagnostic information that identifies a problem, then tells you how to fix it; and lots of information on Brio support options and the ways to connect to them.

Communicate and Share is a great resource for small- or home-business users. Here an Explorer-like interface walks you through sharing your own system resources (files, CD-ROM drive, Zip Drive, or printer) or connecting to shared resources over a network. Other great software loaded on the Brio includes Lotus SmartSuite, McAfee VirusScan, and PC Doctor for Windows for system diagnostics.

The Brio uses a microtower case, which will save lots of space on your desk if you choose to put it there, but the system lacks the expandability features found in other machines here. As configured for our testing (with a 3.2GB hard disk, floppy disk drive, and 32X CD-ROM drive installed), the Brio had just one internal drive bay available. It's fortunate that the Brio has integrated audio and graphics, because with the PCI Fast Ethernet adapter installed, you have just one PCI and one ISA slot left. Upgrading system memory could prove challenging, as the system's drive cage partially blocks the two DIMM sockets in an already cramped interior.

The Brio performed exceptionally well on our Winstone tests, posting the second-highest score in this roundup. But the machine lagged behind its competitors by a huge margin on our

3D WinMark tests. This was because the machine's integrated graphics accelerator—the Matrox Productiva G100 AGP—does not support in hardware many 3-D functions used in the 3D WinMark tests. Also, this subsystem's 2MB of memory will limit you to display a resolution of 1,024-by-768 with 16-bit color.

For customers who will appreciate the Brio's software bundle, this machine is worth the extra money.

Micron Electronics

Micron Millennia C333

For the price-conscious home- and small-office crowd, Micron introduces its Celeron/333-equipped Micron Millennia C333 microtower. This PC kept up with the pack on our tests, and it has an attractive software bundle as well. The machine's price is the lowest here, at \$1,410 (direct); but we'd definitely suggest that you upgrade the installed 4.3GB hard disk to a 6.4GB model, for only \$39 more.

Like HP's Brio, the Millennia is housed in a microtower case, so you might pay in future expansion options for what you save in terms of desktop real estate. The Millennia microtower looks a bit different from the Brio: To promote internal system airflow, a foot or pedestal is integrated in the front of the case, tilting the machine slightly upward. The Millennia does provide just one empty drive bay, like HP's machine, although its two open slots in our test configuration were both PCI and it had two free IRQs.

Turn this microtower around to the back and you'll find an abundance of conveniently labeled ports. These include, in addition to the standard fare, two USB connectors; headphone,

microphone, line-in, line-out, and MIDI ports to complement the machine's 32X CD-ROM drive; integrated Maestro PCI audio; and Advent 009 speakers.

Inside the case is the 333-MHz Celeron processor, flanked by Intel's EX chip set and two DIMM sockets. But also integrated on the motherboard is an nVidia Riva 128 graphics engine with 4MB of memory. These components worked to produce an acceptable score on our Winstone tests, even though it was the lowest of the roundup. The Millennia redeemed itself on 3D WinMark, posting a strong score of 664.

Micron ships this machine with a smattering of software, including Age of Empire, CART Precision Racing, and Microsoft Flight Simulator 98 on the gaming side, as well as Microsoft En-



Micron Millennia C333

Direct price: With 64MB RAM, 4.3GB hard disk, 32X CD-ROM drive, 56.6-Kbps ISA modem, 17-inch monitor, \$1,410

Micron Electronics, Nampa, ID;
888-634-6799, 208-933-3343

www.micronpc.com

403 at www.pcmag.com/infolink

carta 98, Greetings Workshop, Money 98, and Works. The whole shebang is covered by a three-year warranty.

For a single or small-office user with a limited amount of space, the Micron Millennia is an attractive, low-cost machine. **PC**



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Faster...Faster...Faster...

1 Clocked at speeds over 600MHz, the cheetah is the fastest land animal. This "big cat" hunts mainly gazelle, but the average chase lasts only about 20 seconds.

2 In early September 1998, *PC World Magazine* ranks the Micron Millennia the #1 Power Desktop on the market calling it "the fastest of all" systems tested.

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3 The fastest typist in the world types 170 words per minute. To give you some idea of how many words that is, this little blurb is only 36 words long.

4 The newest Micron Millennia features the Intel Pentium II processor 450MHz, the fastest chip available. Don't settle for anything less.

THERE IS NO KNOWLEDGE THAT IS NOT POWER.

— RALPH WALDO EMERSON

10
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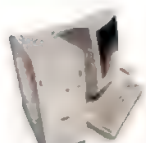
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Model Name **Millennia® C300** **Millennia 350** **Millennia 400** **New! Millennia 450** **New! Millennia 450 MAX**

Processor	Intel® Celeron™ processor 300MHz	Intel Pentium® II processor 350MHz	Intel Pentium II processor 400MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz
Cache	32KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.3GB Ultra ATA hard drive	8.4GB Ultra ATA hard drive	10GB Ultra ATA hard drive	10GB Ultra ATA hard drive	14.4GB 7200 RPM Ultra ATA hard drive
Monitor	15" Micron 500Hz monitor (13.8" display)	17" Micron 700Hz monitor (15.9" display)	17" Micron 700Hz monitor (15.9" display)	17" Micron 700Hz monitor (15.9" display)	19" Micron 900Hz monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	DVD-ROM drive and decoder card***
Graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	Real 3D Startfighter 1740, 8MB AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	64-voice Wavetable 3D stereo sound
Warranty	5-year/3-year Micron Power™ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty

Software Included	Microsoft® Windows® 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition
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Also Includes:	New MicroTower™ case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Advent AV390PL-70 watt 3-piece sound system 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive
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Price	\$1,199 \$42/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,649 \$58/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,849 \$65/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,899 \$66/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,999 \$105/mo. TechRefresh Bus. Lease, 36 mos.**
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Upgrade to:	8.4GB Ultra ATA hard drive 17" Micron 700Hz monitor (15.9" display) 100MB Iomega Zip drive	10GB Ultra ATA hard drive 100MB Iomega Zip drive Microsoft Natural Keyboard Elite	19" Micron 900Hz (18" display) 100MB Iomega Zip drive Advent subwoofer	19" Micron 900Hz (18" display) 100MB Iomega Zip drive Advent subwoofer	100MB Iomega Zip drive 256MB 100MHz SDRAM
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Price	\$1,486 \$52/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,833 \$64/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,232 \$78/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,282 \$80/mo. TechRefresh Bus. Lease, 36 mos.**	\$3,488 \$121/mo. TechRefresh Bus. Lease, 36 mos.**
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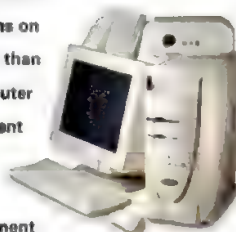
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Millennia 400

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RAM 64MB 100MHz SDRAM memory
Hard Drive 10GB Ultra ATA hard drive
Monitor 17" Micron 700Hz monitor (15.9" display)
DVD/CD-ROM 32X max speed CD-ROM drive
Graphics nVidia Riva 128, 4MB SGRAM 3D AGP graphics
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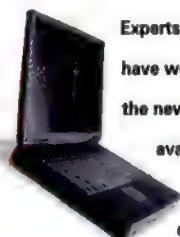
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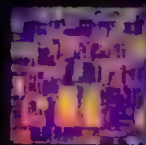
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PDA SOFTWARE

The Written Word

Edit and enter data faster on PDAs with these three handwriting recognition utilities.

By Bruce Brown

A tiny footprint is simultaneously the greatest blessing of palm-size devices and their greatest curse, making data entry terribly awkward. As memory continues to expand in Windows CE palm-size PCs and more add-on applications become available, users have an increasing need to input data.

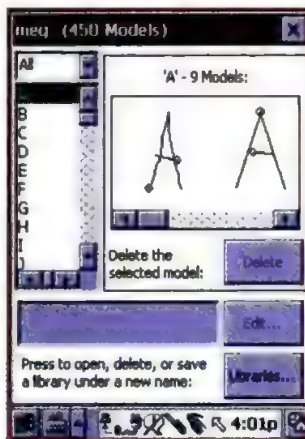
Among the programs available to upgrade the standard data entry utilities for palm-size PCs are ARTrecognition (\$60 street), CalliGrapher 5.1 (\$49.95 direct), and Jot Pro (\$29 direct). Each is designed for specific input styles, and all work across applications on Windows CE palm-size PCs. Some require more handwriting recognition training than others. All three programs are downloadable via the Web.

ARTRECOGNITION

ARTrecognition for the palm-size PC interprets only printing, not cursive writing. It applies typed text entries to the active application on your palm-size PC. ARTrecognition also supports French, German, Italian, Spanish, and Portuguese, as well as English. The software is part of smARTwriter, a bundled product that includes a voice recognition program, Pocket Commander.

The Library of Models in ARTrecognition stores acceptable shapes for characters, the "gestures" feature, macros, and shortcuts. Separate libraries can be set up for multiple users. The program installs with an existing library of 450 distinct characters.

Users can modify their individual character sets through both the character training module—which takes about 8 minutes to complete—and on-



OBEY: You can train ARTrecognition to recognize stored characters.

going selective character editing. You can train ARTrecognition indefinitely to recognize your printing style, in order to lower the error rate. When an error does occur, it's easy to correct in a correction box.

The macro feature in ARTrecognition lets you use drawings or abbreviations to recall character strings. For example, a sketch of a house can represent your name and address. Unlike Jot Pro, with its 1,024-character

limitation, ARTrecognition has no limit beyond device memory. Macros can also be used for shortcut navigation across applications; for example, you can use "\$" to run your expense tracker.

ARTrecognition's standard editing gestures resemble proof-reading marks, and users can also create custom gestures. You'll need to memorize either the standard set or your custom set for maximum efficiency.

If you do a lot of data input while in a moving vehicle, you'll like ARTrecognition's unique Ink-Smoothing feature, which smoothes out the ragged edges of your handwriting. ARTrecognition supports portrait, landscape, and upside-down screen modes for users needing maximum versatility.

ARTrecognition. Street price: \$60. Requires: Host PC running Microsoft Windows CE Services 2.0; 650K memory storage space on a palm-size PC with Windows CE 2.0. Advanced Recognition Technologies Inc., Chatsworth, CA; 888-762-7845, 818-678-3999; www.artcomp.com; 417 at www.pcmag.com/infolink.

Back Up Your Wallet

If you've ever lost your wallet or had it stolen, you might have suffered financial loss and been hassled by the inconvenience of having to report and replace lost cards. QuickWallet (\$20 direct) for your Palm-size PC, from Applian Technologies, stores all your personal information, secures it with a PIN code and encryption, and provides easy screen navigation using either your finger or stylus.

To launch QuickWallet's data encryption, you register on Applian Technologies' Web site, where you're provided with a registration code to enter your QuickWallet PIN number. Since there's no corresponding PC application for QuickWallet, if you forget your PIN, your data is inaccessible. To protect your data in case your palm-size PC is lost or stolen while QuickWallet is open, you can set the program to lock after a number of minutes.

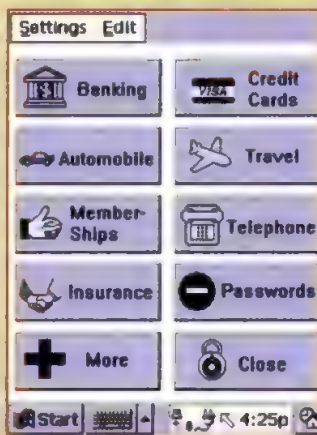
QuickWallet contains 16 sections that each hold up to 512 characters of free-form entry of your personal information. Eight are predefined: banking, automobile, credit cards, travel,

memberships, telephone, insurance, and passwords. Eight more can be customized for information you need to keep handy.

Each of the predefined sections in QuickWallet has minimal suggestions for the type of information to enter. For example, the credit card section has a reminder to enter both the credit card numbers and the phone number listed on the back of each of your cards.

As a convenient record of all those plastic and paper cards in your wallet—and even as a replacement for some of them—QuickWallet is a useful Palm-size PC application. It keeps your personal information organized, accessible, and secure with PIN access and data encryption.—BB

QuickWallet. Direct price: \$20. Requires: Host PC with Windows CE Services 2.0; 61KB memory storage space on a Palm-size PC with Windows CE 2.0. Applian Technologies Inc., San Francisco; 415-831-1499; fax, 415-668-6668; www.applian.com; 418 at www.pcmag.com/infolink.



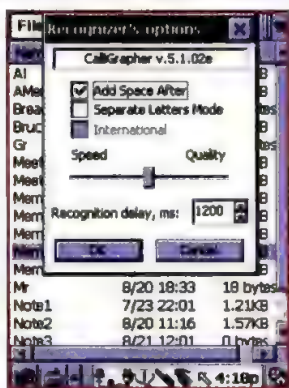
ID: Organize your personal records by category in QuickWallet.

CALLIGRAPHER 5.1

CalliGrapher 5.1 recognizes printing, cursive writing, and combinations of the two styles and converts them to printed text input. Screen drawings are also captured and saved. The neural-network program requires no handwriting training and supports English-language entries; its 64,000-word vocabulary can be supplemented with multiple user dictionaries.

In testing, CalliGrapher 5.1 successfully converted printed, cursive, and mixed text. When you need to correct an error, simply draw the correction gesture (a check mark) and the correction window appears. You can then write the correction on top of the incorrect word or letter or you can choose the desired word or phrase from a list of suggestions. You can also edit text right on the active screen; you need to memorize only a few editing strokes.

Although you can't train CalliGrapher 5.1 to become more accurate in recognizing your handwriting, there are some



WPM: CalliGrapher provides settings for recognition speed and accuracy.

program adjustments that minimize errors. You can, for example, set the speed at which the program converts your handwritten input to printed text. You can also defer its recognition of quick notes and select levels of recognition speed and quality to lower the error rate. In addition, you can

choose not to use cursive and indicate that your writing should be interpreted as separate letters. CalliGrapher 5.1 is a good option for users of palm-size PCs who like to create sketches and diagrams and use their natural handwriting style in many different types of applications. Reserving up to 900K of memory in your palm-size PC for a hand-

writing recognition program that requires minimal memorization and no handwriting training is a reasonable trade-off.

CalliGrapher 5.1. Direct price: \$49.95. Requires: Host PC with Microsoft Windows CE Services 2.0; 550K memory storage space on a palm-size PC with Windows CE 2.0. ParaGraph, a division of Vandem, San Jose, CA; 888-387-7565, 612-253-8375; www.paragraph.com; 415 at pcmag.com/infolink.

JOT PRO

Jot Pro is an upgrade to the Jot Character Recognition System, which is standard on all Windows CE palm-size units. With this upgrade, the input template of the Jot Character Recognition

PalmPilot Input

T9 (\$40 street) text input is a faster input alternative to the integrated Graffiti alphabet and miniature electronic keyboard in your 3Com Palm device. T9 refers to the utility's telephone-like keypad that has "text on nine keys." T9 has a linguistic database that quickly and accurately converts keystrokes to the most likely word and punctuation.

Using T9 requires trust, because a word can look like gibberish until it is completely keyed. For example, to enter the word, "common," you use only two blocks on the keypad, tapping the block with the letters ABC once and the block with MNO five times. As you tap the blocks the words *an, con, boom,*

commo, and finally *common* are displayed. If the T9 doesn't display the word you want, you can choose the correct one from the word list or enter it in the database by tapping on the exact letters in each block.

In addition to the text keypad, T9 has separate keypads for numbers, symbols, and international letters. T9 is available in ten languages besides English and is compatible with most integrated and add-on applications that have been developed for the Palm OS. —BB

T9. Street price: \$40. Requires: Host PC running Palm Desktop 2.0 or higher, 177KB memory storage space on a 3COM Pilot 1000/5000, PalmPilot Personal/Professional, Palm III, IBM WorkPad with Palm OS version 2.0 or higher. Tegic Communications, Seattle; 206-343-7001; fax: 206-343-7004; www.tegic.com; 419 at www.pcmag.com/infolink.



GRAFFITI-FREE: T9's telephone-like keyboard.

System is eliminated; you can now use the entire screen. Characters are entered in the application field you have highlighted.

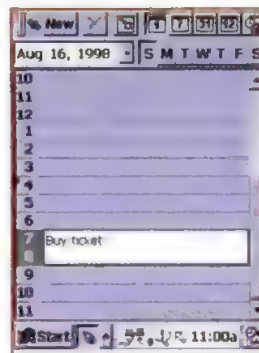
With Jot Pro a small pointer is displayed at the midpoint of each side of the screen. Lowercase letters and numbers are printed below the imaginary horizontal line between the pointers, and uppercase letters are printed across the line. You have the option of moving the pointers to the top and bottom of the screen to position the imaginary line vertically.

With Jot Pro you can enter up to 1,024 characters for recall with a seven-letter macro name. This feature is useful for reusing longer entries, such as directions. Like the standard recognizer, Jot Pro does not recognize cursive writing, so it doesn't require extensive handwriting training. A tutorial on its nat-

ural character set is included. Jot Pro also recognizes the simplified character set of the Graffiti alphabet, used with 3Com Palm devices.

Jot Pro is recommended for users of palm-size PCs who are comfortable with printing over the fields of any application screen and can conform to Jot Pro's natural character set. Jot Pro's invisible, space-saving features support high-volume data entry.

Jot Pro. Direct price: \$29. Requires: Host PC running Microsoft Windows CE Services 2.0; 150K memory storage space on a palm-size PC with Windows CE 2.0. Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242, 650-802-7888; www.cic.com; 416 at www.pcmag.com/infolink.



ENTER HERE: Jot Pro displays two screen pointers to define input areas.

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First Looks

HOME COMPUTERS

The Intriguing iMac

Apple Computer turns an entire industry on its ear with the translucent-blue, all-in-one iMac.

By Tom Pope

Retailers have been reporting record sales of Apple Computer's iMac, and in Mac-specific newsgroups the reactions of its new owners have been overwhelmingly favorable. We decided to look for ourselves to see whether the iMac lives up to its promise.

The first thing we wanted to test was Apple's assertion that the iMac (\$1,300 street) was faster than a 400-MHz Pentium II PC and up to three times faster than similarly priced PCs. To do so, we developed 19 tests on 8 different cross-platform applications and ran all of them on the iMac, a 400-MHz Pentium II, and a 333-MHz Celeron PC.

Reality falls far short of Apple's claims: The iMac was outperformed on most of our application-based tests by both the Pentium II and Celeron PCs. For complete test results, discussion of those results, and information on our testing methodology, visit our Web site at www.pcmag.com.

The iMac is extremely easy to set up—we had it unpacked, up and running, and on our network in less than 10 minutes. The keyboard has a small footprint, but the keys are the same size as those you'd find on a PC keyboard (except for the function keys, which are about half-size).

You'll need to get used to the mouse, however. It's round, so accidentally pointing it in the wrong direction is easy. But its motion is very smooth, and its small size makes the mouse great for kids.

The monitor may seem small at first blush, but the quality is im-

pressive. It provides good refresh rates (75 Hz at 1,024-by-768), and its 0.28-inch dot pitch makes for a crisp, flicker-free display.

INSIDE: A PENTIUM KILLER?

The iMac is powered by a 233-MHz PowerPC 750 (G3) processor, a 4GB hard disk,



available by the time you read this. There's Imation's SuperDisk drive (\$150 street),



PORT ABILITY: On the side of the iMac, you'll find two USB ports, an RJ-11 jack, an RJ-45 jack, mic input external speaker output, and set and interrupt buttons.

32MB of RAM, a 24X CD-ROM drive, and built-in 10/100-Mbps Ethernet. It also has built-in stereo surround speakers and a 15-inch multiple-scan shadow-mask monitor.

The integrated ATI Rage IIC graphics chip is coupled with only 2MB of SGRAM, limiting color depth to 16-bit at 1,024-by-768 resolution. This should be

sufficient for most iMac users, but if you need more, you can upgrade the SGRAM.

NO FLOPPY, BUT USB

Apple's decision to build the iMac without a floppy disk drive at first struck us as loopy. How do you transfer existing files or trade data with a friend? Many consider the floppy disk a dead technology, and Apple wanted to drive that point home by doing away with it.

There are other storage options, however, that should be

which will store up to 120MB of data per disk and can read both Mac- and PC-formatted floppy disks. Iomega is also planning an iMac-specific external Zip drive (\$200 street).

Many people were also scratching their heads over Apple's decision to go with USB instead of the SCSI/ADB combination used in all but the

earliest Macs. This is the first that Mac users have heard about USB, as it's never been part of any other Mac.

Few products are available for Mac USB now, but because USB is cross-platform, anything for PCs can be used by the iMac with a driver rewrite. Several dozen USB products have already been announced; there will be many more, including USB-to-serial and USB-to-ADB devices, which will enable those with older peripherals to connect to the iMac.

This forward-thinking approach also applies to the iMac's 56K V.90 modem. Some early iMac users reported having trouble connecting to ISPs not yet upgraded to V.90. Apple posted an alternative modem script on its Web site that lets the modem dial in reliably at 33.6 Kbps to non-V.90 ISPs. The iMac will also run Apple's next-generation operating system—MacOS X—when it is released next year.

We found the iMac visually appealing and enjoyable to use. Apple's claims of Pentium-killing power are clearly overstated, but the iMac still succeeds extremely well at being what it was intended to be: a fast, easy-to-use machine that will remain viable long after the warranty runs out.

iMac. Street price: \$1,300 with 4GB hard disk, 32MB SDRAM, 24X CD-ROM drive, 56K V.90 modem, 10/100Base-T Ethernet. Apple Computer Inc., Cupertino, CA; 408-996-1010; www.apple.com; 414 at www.pcmag.com/infolink.

PERFORMANCE TESTS

iMac vs. Celeron/333 and Pentium II/400



The test results below represent a mix of applications typically run on both platforms. For more test results—including FileMaker Pro 4.0, Micro-

soft Word and Excel, and Ray Dream Studio 5 Renderer—plus complete technical discussions of what the numbers mean and how we tested, visit our Web site at www.pcmag.com.

▲ High scores are best.

▼ Low scores are best.

Bold type denotes first place.

	ClarisWorks 5.0		Adobe Photoshop 5.0		Quake	
	Spell-Check (seconds) ▼	Search-and-Replace (seconds) ▼	Gaussian Blur (seconds) ▼	Lighting Effects (seconds) ▼	Timedemo 2 (frames/sec) ▲	Timedemo 3 (frames/sec) ▲
iMac	4	12	5	49	18.9	16.2
Dell Dimension V333c (Celeron/333)	10	13	3	30	26.8	22.8
Dell Dimension R400 (Pentium/400)	17	10	2	26	41.8	34

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— John C. Dvorak, PC Magazine,
Sept. 1, 1998

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.WORK THE WEB.



SMILE, MaKE EyE CONTACT and keep the soles of your feet to yourself,

Ted remembered from the in-flight article he had read.

In the Middle East, it's offensive to expose the soles of your feet. And here he was, the principal of an engineering firm, in Dubai, trying not to build the bridge too far.

¹(His company) was based in Reno, Nevada—which might seem like a strange place for an international engineering firm if the tax structure weren't so friendly. But that presented challenges. Most of Ted's colleagues were strewn to the four corners of the globe.

The ability to ²(send e-mail and schedule meetings) was paramount—with architects in Salt Lake City, fabricators in São Paulo, financiers in Geneva. As their company grew, so did their reliance on the Web to ³(share information and get new clients). Control was critical.

Because ⁴(managing projects on-time, on-budget) for his company and his clients was one of the reasons they were starting to win so many contracts. This, and their left foot not tripping over their right. Though today they wouldn't be propped up on a desk.

THE ⁵(BEST PARTS) OF HIS DAY WERE MADE POSSIBLE BY LOTUS.

¹Lotus Domino™ server gateway. ²Lotus Notes® scheduling and e-mail. ³Domino-based Interactive Website.

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First Looks

PDA's

New REX with Data Entry

The new REX PRO PC-Card Organizer now supports limited data entry and boosts memory to 512K.

By Bruce Brown

Building on the success of its first credit-card-size organizer, Franklin Electronic Publishers introduces round two: the new REX PRO PC-Card Organizer (\$230 street). This device is even more useful, with more storage capacity, data-entry capabilities, and more synchronization options.

Except for checking off to-do items, the first REX was a read-only device. The REX PRO's SuperKey Light Data Entry System lets you scroll through the alphabet to select one letter at a time to add notes, contacts, tasks, or appointment data. This task is arduous, but it works. You can also now delete contacts, tasks, appointments, and notes. Data-entry functions are activated by a button with a pencil-shaped icon, located to the right of the reflective 2.2 by 1.3 inches (WH) LCD monochrome display.

Like the REX, the REX PRO's applications include daily calendar entries, a contact database, a task list, a memo reader, and a dual-time-zone world clock. The PRO is rated to hold up to 6,000 entries in its 512K memory; doubling the capacity of the original REX.

In testing the earlier version, the maximum number of name and telephone number entries we could load using real-world data was 2,234. The new model easily handles more inclusive information on greater than 3,200 contacts, plus a small task list and current schedule. The device has no memory usage gauge, however, which would have been a helpful addition.

Two bundled appli-

cations present alternative ways to add and update data. Starfish Software's TrueSync Desktop is a standalone PC PIM application that synchronizes directly with the REX PRO. TrueSync Plus lets REX PRO users synchronize directly with data stored in major PIMs, including ACT! and Microsoft's Outlook. Previously, PIM data had to be converted to TrueSync Desktop format.

In testing with TrueSync Plus and Outlook 98 using a PC Card slot on a notebook PC, an initial 3,000-plus contact record synchronization took under 5 min-

utes, and updates took roughly 1 minute. Sync times will vary depending on the number of changes, the amount of data involved, and the speed and resources of the host PC.

already terrific product.

REX PRO PC-Card Organizer. Street price: \$230. Requires: 8MB RAM; 12MB hard disk space; PC Card Type II slot or 9-pin



WRITE ON: Press the REX PRO's pencil icon to add data.

New synchronization options, data entry, and doubled storage space significantly improve an

serial port; Windows 95,

98, or NT 4.0. Franklin Electronic Publishers, Burlington, NJ; 888-739-6400, 609-386-2500; www.franklin.com; 404 at www.pcmag.com/infolink.

PERSONAL FINANCE SOFTWARE

A Clean, Mean, Money 99

In an ongoing effort to defeat all contenders, Microsoft Money 99 is ready to challenge Quicken.

By Kathy Yakal

Microsoft shocked the personal finance software world last year by producing a version of Money with legs. We have yet to see if Microsoft Money 99 (\$64.95 list) can out-run Quicken 99, but it's clean, mean, and ready to rumble.

Microsoft has made substantive changes to every element of its personal finance program

and has improved usability. The company has continued to integrate Money with its two related Web sites—Money Insider and Microsoft Investor—and to plant Web-like operations within the program itself.

One new feature, Personal Profile, pops up early on: Answer several questions and Money will display a page suggesting which of the program's features you should use. A good idea in theory, but it's thinly executed.

Of more help to both new and seasoned users is Money's Financial Home Page, which appears when you open Money unless you specify otherwise. You can design the page yourself, selecting which elements should ap-

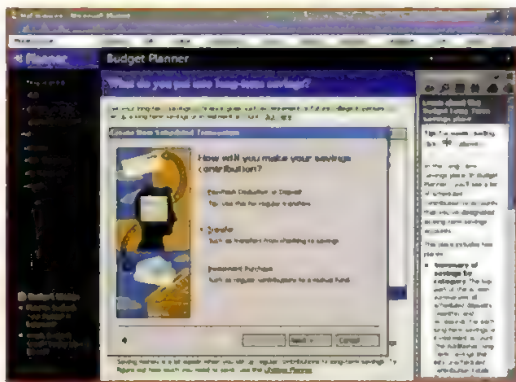
pear (articles from Web sites or bill reminders, for example).

Microsoft Investor is a powerful partner for Money, feeding it quotes, news, and analysis. You can now track employee stock options and set up a watch list for securities.

Money 98's planning features were already impressive, and Microsoft has added even more. The steps required for making a budget and goals are laid out in greater detail and with more screens, making the process less confusing than in Money 98.

Web devotees will probably like Money because of its Web-like design. Others will like it just because it's clean, easy to use, draws on Web resources when that makes sense, and provides very good tools for daily financial management and lifetime financial planning.

Microsoft Money 99. List price: \$64.95. Requires: 16MB RAM, 40MB hard disk space (120MB if Internet Explorer 4.01 Service Pack 1 or later is not installed), Microsoft Windows 95, 98, or NT 4.0 or higher. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com; 405 at www.pcmag.com/infolink.



EASY MONEY: Money 99's Budget Planner is easier to use, thanks to wizards and a better Help system.



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First Looks

UTILITIES

New Norton AntiVirus

A new user interface, virus detection tools, and problem diagnosis via e-mail pump up Symantec's latest release.

By Barry Simon

When Symantec releases a new version of Norton AntiVirus (NAV), it's big news. But the event is even more newsworthy with the recent consolidation of the anti-virus market. NAV 5.0 (\$50 street) includes new versions for Microsoft Windows 95, 98, and Windows NT Workstation 4.0, as well as the older NAV 4.0 versions for Windows 3.1, DOS, and Windows NT 3.51.

The most notable improvement from NAV 4 involves virus-scanning technology. NAV 4's virus scanner set up a virtual computer for safely executing the start of program files, looking specifically for a polymorphic class of viruses. Using a syn-

thesis of search technology from IBM and the virtual-machine idea, NAV 5.0 tries to locate any specious viruslike files.

Scan and Deliver lets you e-mail a safely wrapped virus to Symantec's AntiVirus Lab. In many cases the process is automated, so the response can be quick. On our test, turnaround time was about 30 minutes.

Also in this version, you can incrementally update virus-definition files rather than download a complete file each time. Previous versions of NAV included lifetime download updates; with NAV 5.0, free updates are limited to a year. After that, annual subscriptions are \$4.95.

One way to ensure that you frequently update virus defini-

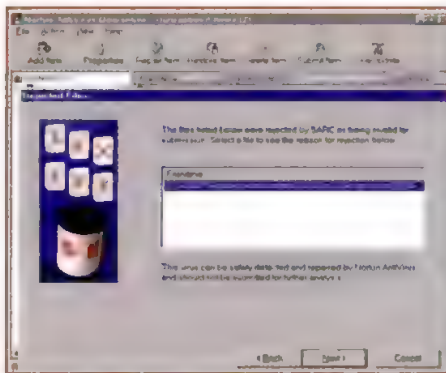
tions and scan disks is with NAV 5.0's Program Scheduler, which automates the process. NAV 5.0 installs Program Scheduler under Windows 95 and NT 4.0. Under Windows 98, NAV uses the OS's built-in scheduler.

We set the clock forward six

and some text indicating that the outdated files should be updated.

About 70 percent of the time, our Windows 98 test PC crashed during shutdown after NAV was installed. This problem was harmless but annoying enough that we were glad when tech support found a fix.

You can't afford to be without virus protection, and NAV 5.0 remains at the top. **Norton AntiVirus 5.0.** List price: \$49 (competitive upgrade, \$29.95). Requires: 8MB RAM (16MB for Windows NT); 24MB hard disk space, Microsoft Windows 95, 98,



BY MAIL: NAV's Scan and Deliver e-mails infected files to Symantec's antivirus research center.

months on one of our test PCs to see how NAV would react to an out-of-date virus-definition file. You'll have to look closely at the main panel to see a small icon

or NT Workstation 4.0. Symantec Corp., Cupertino, CA; 800-441-7234, 541-334-6054; www.symantec.com. 410 at www.pcmag.com/infolink

UTILITIES

Adding to Windows

Gizmos 98 provides an abundance of goodies—from calculators and calendars to multimedia slide-show makers.

By Barry Simon

If you want to add more functionality to Windows or you're just getting bored with your desktop, Play's Gizmos 98 (\$49.95 list) has everything you need. This cornucopia of delights includes clocks, games, a CD player, screen savers, desktop themes, file shredding and encryption, and a multimedia slide-show maker. (For even more gizmos, check out the review online at www.firstlooks.com.)

Gizmos 98's most exciting application is Performer, its slide-show maker. Drag pictures onto a timeline and Play's transitional effects will wow your audience. You can also drag WAV sound files into your slide shows and have them loop for background music or play in coordi-

nation with individual slides.

Slide shows can be packaged and sent with an included player over e-mail. But since the player is about 2MB and packaged slide shows can easily be many megabytes, those you e-mail to had better have a thick pipe to the Internet.

The highlights of the package include the Pro Linear CD Player, which can link to the Internet to look up music and track titles for your CDs. The clocks link to the Naval Observatory Atomic Clock and automatically set the correct time.

All the modules

in Gizmos 98 are visually stunning. In the solitaire games, for example, the play area looks like green felt and the trays like polished wood. The rotating cube screen saver will make any passerby stop and look.

This impressive collection does have some problems. The programs loaded adequately on our dual 400-MHz Pentium II system running Windows NT, but some were painfully slow when loading on a Windows 98 150-MHz Pentium system.



APPLETS: Gizmos 98 includes (clockwise): solitaire, a calculator, calendar, clock, launch tool, CD player.

Gizmos 98's nonstandard interface avoids such things as menus, which would destroy its visual impact. This is often awkward, especially since there are no ToolTips for buttons and icons. And in the few places where you can load files, the programs use a home-grown file list instead of Windows' open dialogs.

I quickly developed a long wish list of features that didn't make this first version. You can't print from Picture Explorer or track wins and losses in the card games, for example. But these flaws are minor in what is a superb collection of applications.

Gizmos 98. List price: \$49.95 Requires: 16MB RAM (32 MB for Windows NT), 71MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Play Inc., Rancho Cordova, CA; 800-306-7529, 916-851-0800; www.play.com; 411 at www.pcmag.com/infolink.

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First Looks

ANIMATION SOFTWARE

Animate on the High End

The newest version of 3D Studio MAX produces impressive movie-quality animation.

By Luisa Simone

The latest release of 3D Studio MAX from Kinetix intensifies its focus on the entertainment industry. This new version includes tools that specifically target film, broadcast video, and games developers.

Using the Camera Tracker

the size of both the feature to be tracked and the area to be searched for movement.

Success, however, requires rigorous attention to detail. Each frame of a background movie must contain at least six visible markers.

The Camera Tracker utility lets you position motion-tracking gizmos with subpixel accuracy.

You'll also need exact measurements of the real-world

scene in order to position the Cam Point helper objects properly in your 3-D scene.

This release of 3D Studio MAX fleshes out the NURBS feature set with new surface and curve types.

You can connect any number of curves to create a UV loft surface or generate a one- or two-rail sweep (where two or more curves determine the sweep's

path). The new curve types (including normal projected curves and CV or Point Curves on Surface) can be used to trim or cut a hole into a NURBS surface.

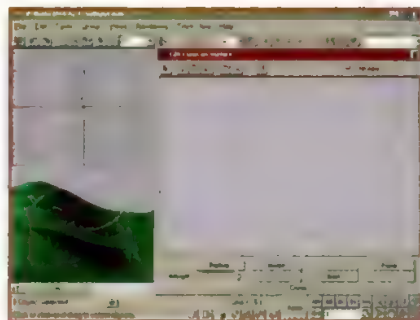
Games developers who work with low-polygon-count models will appreciate the new mesh-editing tools. The Slice plane can be moved and rotated to segment a single selected face or multiple objects. The Cut tool lets you divide faces at any specified point.

Assigning materials to objects and even creating complex materials has never been easier, thanks to a new drag-and-drop implementation. Dropping a material directly onto a selected face automatically generates a multi/subobject material in the Material Editor.

3D Studio MAX both imports and exports Apple QuickTime movies. The program can also read and write VRML97 and offers helper objects to optimize performance of virtual worlds on the Internet. Output

to the Kodak Cineon and RGB bitmap formats eases the task of integrating 3-D animations with live-action filmed footage.

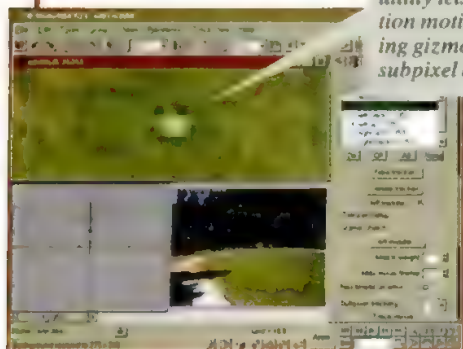
Though it makes heavy demands on both system resources and user skills, 3D Studio MAX



CURVES: 3D Studio MAX lets you project a curve onto an irregular NURBS surface.

gives desktop producers the power to compete in professional film and video markets.

3D Studio MAX R2.5. List price: \$3,495 (upgrade \$95). Requires: 64MB RAM, 200MB swap space, Microsoft Windows 95 or NT 4.0 (with Service Pack 3). Kinetix, A Division of Autodesk Inc., San Francisco; 800-879-4233, 415-547-2000; www.ktx.com; 406 at www.pcmag.com/infolink.



IN SYNC: The goal is to sync the gizmos (left window) with markers in each frame of the video in the perspective window.

er, you can mimic the motion of a real camera to superimpose a computer generated (CG) animation convincingly onto live-action footage. Camera tracking requires you to shoot a real-world scene with visible markers, create Cam Pointer helper objects in your 3-D scene, and then use special motion-tracking gizmos to associate each marker in the film with a corresponding Cam Pointer.

3D Studio MAX then analyzes each frame of the movie to create a motion path based on the markers' changing positions. That path is subsequently applied to a MAX camera when you animate the scene.

3D Studio MAX provides sophisticated tools for this difficult task. You can, for example, keyframe camera functions to match the real-world camera more precisely. And the motion-tracking gizmo lets you specify

How They Made the Baby Dance

Kinetix has also released a new version of Character Studio—the 3D Studio MAX plug-in responsible for realistic animations, such as the ubiquitous dancing baby on “Ally McBeal.” Character Studio R2 (\$1,495 list), consists of two modules: Biped, which controls the motion of two-footed creatures, and Physique, which attaches skin to either a Biped or 3D Studio MAX hierarchical skeleton.

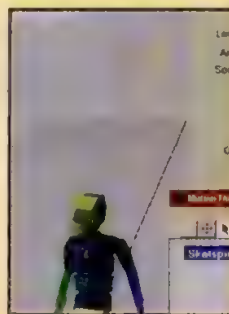
In addition to its patented footstep and freeform keyframe animation, Biped now imports motion-capture data in either Biovision's BVH format or Character Studio's ASCII CSM format. The complexity of this data, recorded via sensors attached to a live model, produces truly believable movement.

Character Studio can also analyze the data to reduce complexity and make the resulting animation easier to edit. The plug-in ships

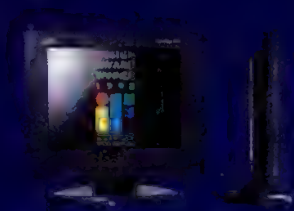
with 150 individual movements. You can also compose longer sequences by combining two or more motion clips.

Other improvements make complex animation procedures easier. With In-Place editing, a character displays motions but doesn't cover any ground, so you don't have to create a follow camera or scroll the viewport to keep the figure in sight. Likewise, Physique skins are easier to initialize and provide more realistic behavior. The end result is a more lifelike CG character.—LS

Character Studio R2. List price: \$1,495 (upgrade \$495). 406 at www.pcmag.com/infolink.



Ghost stick figures help choose the best transition posture between footstep sequences.



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March 18, 1998**

First Looks

DIGITAL CAMERAS

Megapixel on the Cheap

The Toshiba PDR-M1 Digital Still Camera adds low cost to small size and high resolution.

By Bruce Brown

The new Toshiba PDR-M1 Digital Still Camera (\$600 street) is a compact camera suitable for both business professionals and photo hobbyists. The PDR-M1 combines removable, reusable SmartMedia (4MB included), a 1.5 megapixel 1,280-by-1,024 maximum resolution 0.5-inch CCD, and a 1.8-inch color LCD for composing and reviewing images.

The 3.3 by 4.8 by 1.6-inch (HWD) PDR-M1 weighs 11.8 ounces with batteries installed. The camera's striking metal case has a protective lens cover and a Mode Dial with color-coded menu icons on the back. Setting up the camera is easy: Simply insert the included four double-A batteries and paper-thin 1.5- by 1.4-inch 4MB SmartMedia flash memory card. (The camera also supports 8MB and 16MB cards.)

The image-capture setup instructions are disorganized in the owner's manual but easy to navigate on the LCD display. There are eight settings for auto and manual modes, including four flash options, three image-quality choices, two file sizes (1,280-by-1,024 and 640-by-480), and three sharpness settings.

In manual mode, you can fine-tune for white balance, brightness, flash power, and shutter speed. The PDR-M1 has a 2X digital zoom and a macro mode for subjects between 3.5 to 20 inches from the camera.

Within 6 seconds of turning the PDR-M1 on, it's ready to shoot. When we used auto mode, we obtained higher-quality images with outdoor lighting than interior shots. You can expect the 4MB

media card to store from 6 to 8 high-resolution images and up to 80 images in low resolution with high compression.

You can download images to a PC via the included serial cable or to a television or monitor with the video cable, also included. Toshiba's optional FlashPath floppy disk adapter (\$95 street) has a slot for a SmartMedia card and fits in a conventional 3.5-inch floppy disk drive. With the adapter you can read and write image files directly between the Smart-

Media card and the PC.

The PDR-M1 comes with two Sierra Imaging applications.



CLICK: The PDR-M1 will please pros and hobbyists alike.

Image Expert edits photos and captures and organizes audio files, and Camio displays images

on the PC in a filmstrip graphic so you can select and transfer them to Image Expert or to other photo-editing applications.

If you want a relatively inexpensive and compact digital camera with megapixel image-capture capability and options for rapidly downloading images to your TV or PC, the Toshiba PDR-M1 Digital Still Camera is a match.

Toshiba PDR-M1 Digital Still Camera. Street price: \$600. Requires: 16MB RAM, 20MB hard disk space, Microsoft Windows 3.x, 95, or 98. Toshiba America Information Systems, Imaging Systems Division, Irvine, CA; 800-288-1354, 714-461-4991; www.dsc.toshiba.com. 409 at www.pcmag.com/infolink.

FAX SOFTWARE

Feature-Rich WinFax

The newest version of Symantec's PC-based fax program is full of features and priced just right.

By Alfred Poor

WinFax is one of those products that defines the standard. Yet Symantec makes sure the program keeps up with the changing needs of its users. The newest version, WinFax PRO 9.0, is chock-full of features that may leave some buyers wondering how the

direct access to fax features in many programs; you can also simply print to the fax driver from any Windows program.

The extra features in WinFax are what create its appeal. For example, the software includes modem-sharing support. You can set up a PC as the server on any network with IP support, then set up other PCs as clients. WinFax also supports multiple modems at one time and Internet fax services, as well as other devices, such as ISDN adapters.

WinFax also includes mobile support. You can define different locations quickly, and there's a wizard that already knows the calling-card formats for most long-distance services. Incoming faxes can trigger pager notification or automatic forwarding to another fax number or an e-mail account.

The program comes with a huge collection of cover pages,

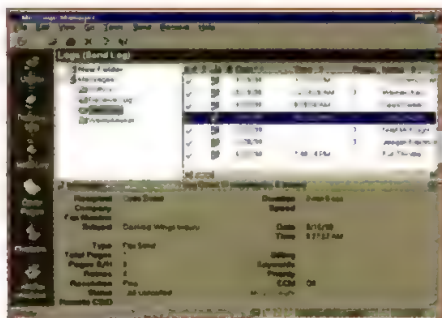
though the Cover Page Designer makes it easy to create your own. A new, integrated Windows Explorer-like interface uses the same screen to view faxes and attachments and to access the address book.

WinFax supports multiple address books, and it can automatically link to many PIM databases. On our tests, the software automatically located and installed a Day-Timer Organizer database, making all the address book entries immediately available.

Dialing and transmissions are quick and effective. The program also includes Xerox TextBridge, for OCR; we tested this feature on files that had been converted to fax attachments, and the conversion back to text was nearly perfect (though not on preserving layout and text formatting).

With a wide range of features, ease of use, and attractive pricing, chances are users won't be taking Symantec up on its 60-day money-back guarantee.

WinFax PRO 9.0. Street price: \$120. Requires: 16MB RAM, 57MB hard disk space. Symantec Corp., Cupertino, CA; 800-441-7234, 541-334-6054; www.symantec.com; 410 at www.pcmag.com/infolink.



WIN-WIN: WinFax's new GUI provides fast access to faxes, phone books, and attachments.

street price can be just \$120.

By now, most Windows users are already familiar with the advantages of computer-based fax. And with WinFax, macros give



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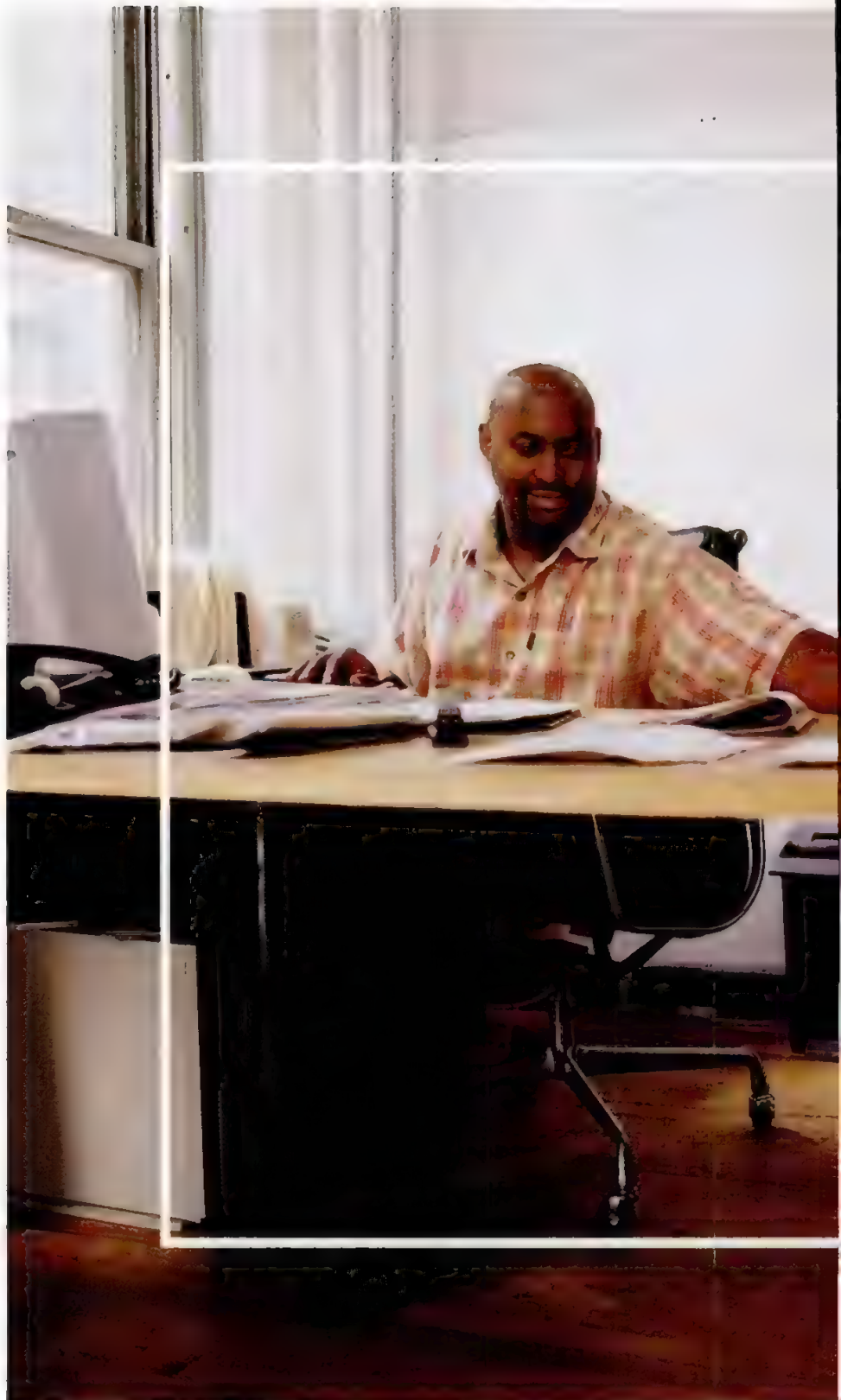
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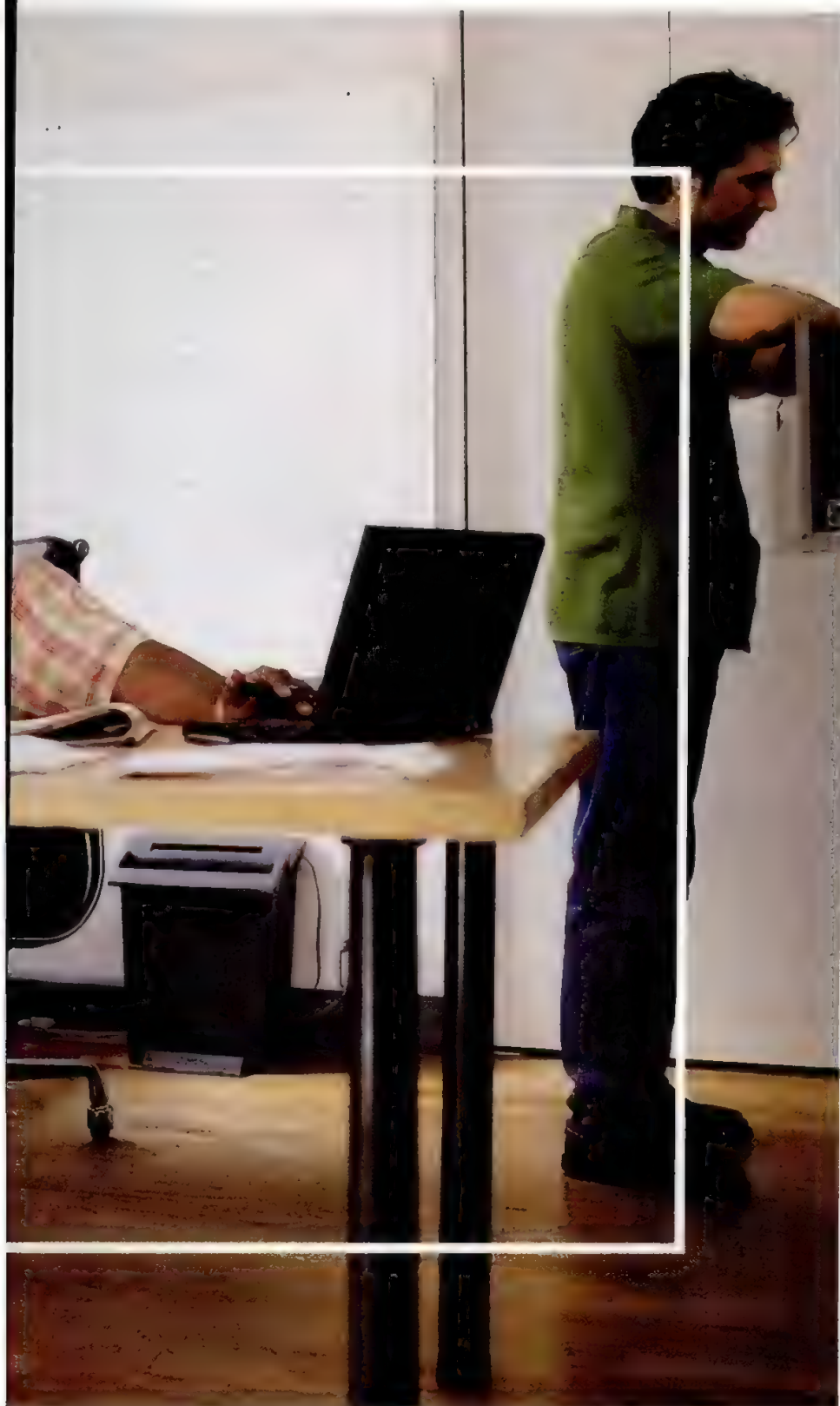
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First Looks

STREAMING MEDIA

Video Unplugged

With Emblaze VideoPro, visitors to your Web site can see streaming video without downloading a plug-in.

By Jan Ozer

Complicating streaming video usage are Web surfers who don't know what a plug-in is and don't really care; they just want video to play when they push a button. One innovative solution is Emblaze VideoPro (\$295 list), which uses Java to enable video without plug-ins.

VideoPro has two components—the encoder and Java-class playback libraries. The encoder accepts standard AVI files and offers presets and batch capabilities. You can also customize output for data rate and frame rate, resize videos to selected resolutions, and mute and normalize the audio track.

The encoder creates all

HTML code with options for auto-start or on-demand play and prebuffering to ensure smooth playback. Simply copy relevant segments into your HTML editor.

In general, the encoder is easy to use. The only caution is that presets compress to the full bandwidth of the target, producing, for example, a file with a 28.8-Kbps bandwidth for 28.8-Kbps connections. (Most other encoders assume a more realistic 20 Kbps.)

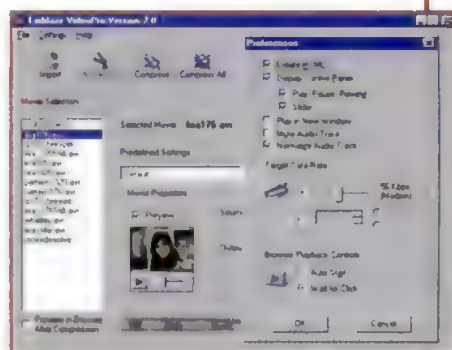
Configuring video files for playback from your Web server is simple: Place the Java library files from the VideoPro CD-ROM in the same directory as your video files and the embed-

ded HTML code takes care of the rest.

On all browsers except IE 4.0, the files stay active as long as the browser remains open but must be downloaded for each subsequent session. IE 4.0 users can opt to retain Java libraries and avoid this problem.

We noticed some distortion in compressed animations. And videos with resolutions larger than 176-by-132 played very slowly, even on a 350-MHz Pentium II. Smaller-resolution files played well on a 200-MHz Pentium/MMX, so you're probably safe with 176-by-132 and smaller files.

Since Geo doesn't offer a Web server, you can't control video throughput on a network, which disqualifies Emblaze for many intranets. The player is also fairly spartan, lacking common con-



ENCODE: Emblaze VideoPro's encoder is easy to use, produces high-quality output, and offers advanced features.

trols such as volume and zoom. But if your viewers are plug-in phobic, Geo's simple solution produces high-quality output. **Emblaze VideoPro.** List price: \$295. Requires: 12MB RAM, 5MB hard disk space, Microsoft Windows 95, 98, or NT 4.0 or later. Geo Interactive, Woodland Hills, CA; 800-576-7751, 818-703-8436; www.emblaze.com; 407 at www.pcmag.com/infolink.

WEB GRAPHICS SOFTWARE

Animations with a Twist

Extensis' PhotoAnimator 1.0 provides a powerful and flexible means to create Web GIF animations.

By Luisa Simone

A new GIF animation product from Extensis, PhotoAnimator 1.0, bridges the gap between low-end frame compilers and high-end multimedia authoring tools by combining sophisticated animation tools and powerful optimization functions at an affordable \$99 (list) price.

Aided by an interface that borrows key conventions found in other graphics and multimedia editing programs, PhotoAnimator has several functions that make creating animations easier than ever. Chief among them is the live preview of your movies. In addition, PhotoAnimator can *tween* (create in-between frames) for rotation, movement, and sizing effects. You need to set only general parameters for a Cel in order to have PhotoAnimator in-

crement the effect automatically.

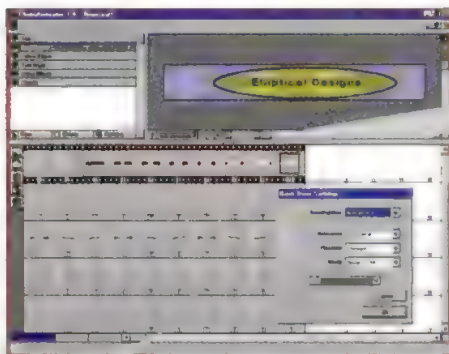
Best of all, if you save your work as a PhotoAnimator PAF file, the effect is completely editable. This is a major improvement over manual creation methods.

Extensis develops Photoshop plug-ins, and this is reflected in PhotoAnimator's features. For example, the program reads and writes only GIF and PSD files. Likewise, users must master the use of 8-bit grayscale images to create transition and masking effects. Because PhotoAnimator sees itself as an adjunct to an image-editing program, it provides no selection, painting, or text tools.

There are advantages to this approach. For example, PhotoAnimator can quickly generate numerous Cels from a single image by preserving layers, maintaining transparency masks, and rasterizing the text (but not layer effects) in a PSD file. And importing a grayscale image as a PhotoAnimator mask or transition means that users can create

frame compression, help you produce GIF animations that download efficiently and look good on the Web. The program also boasts an internal color picker that snaps to Web-safe hues.

There are few things PhotoAnimator lacks, including key-framed animation and the ability to apply multiple effects to the same Cel (though this is mitigated somewhat by the program's ability



Multiple tracks in PhotoAnimator's Filmstrip pane allow you to overlay and animate any number of Cels.

their own custom effects.

PhotoAnimator's output options, which include color reduction, transparency, and both inter- and intra-

PhotoAnimator's VCR-like controls let you play animations at any time.

to nest subanimations). But PhotoAnimator still has immediate benefits and the potential to become indispensable.

PhotoAnimator 1.0. List Price: \$99.95. Requires: Microsoft Windows 95, 98, or NT 4.0 or later, 16MB RAM, 8MB hard disk space. Extensis Corp., Portland, OR, 503-274-2020; www.extensis.com; 408 at www.pcmag.com/infolink.

COMMUNICATIONS

PC Paging System

HotPage 3.0 lets you organize and send e-mail and alphanumeric pages from your PC to a pager.

By Bruce Brown

Smith Micro Software's HotPage Version 3.0 (\$40 street) introduces HotPage Desktop, a no-frills utility for sending alphanumeric pages from your PC. The original HotPage runs only as part of the supported e-mail systems, but HotPage Desktop is a standalone program and broadens the product's potential user base.

HotPage Desktop is ideal for those who send a lot of pages to multiple recipients. Users don't have to rely on paging service operators, and they can manage contact information and message activity from a PC, without having to integrate with any other application.

The HotPage setup wizard helps configure your PC for outgoing calls to pager services and confirms modem operation. You can configure HotPage Desktop to run automatically whenever Windows starts, to ensure scheduled pages are sent.

In HotPage Desktop's phone book, contacts are set up individually or in groups for broadcasting messages. Each record includes personal information, paging service name and phone number, and pager ID. For alphanumeric pagers you enter the maximum characters allowed per message (which varies by service). Multiple pager connections can be entered for a single contact.

HotPage Desktop provides a menu of the most well-known paging services and phone numbers, called TAP numbers. You might need to adjust some paging services' numbers with their representatives to establish PC connectivity.

Sending a page involves selecting the contact from the phone book, entering the message, and

clicking on the pager icon. You can schedule pages for later delivery and resend messages automatically. Standard and custom Quick Messages, such as "Call the Office," are available.

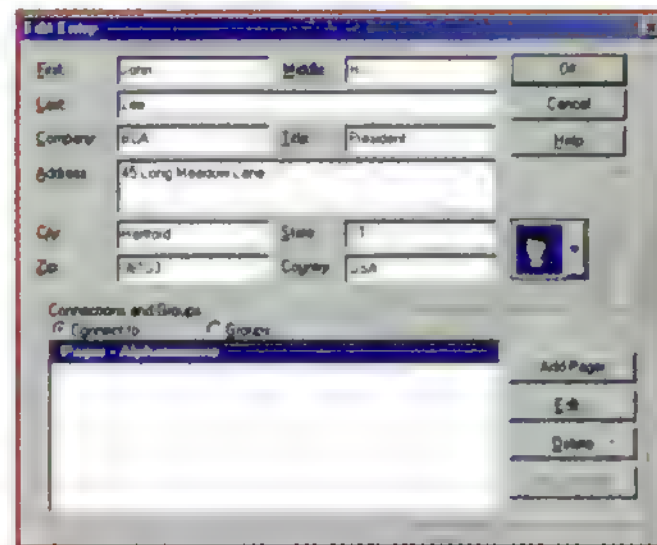
The modem activity box shows the dialing status and confirms when the page is sent. It would be helpful if the paging service name and number were displayed in the activity box to verify the connection was made.

The basic HotPage program is unchanged from the prior version. One of its functions is to forward

e-mail messages from Microsoft Exchange, Windows Messaging, and Outlook to alphanumeric pagers. You can filter the content and timing of e-mail messages sent to your pager by sender, priority, days, and times. You can also send numeric or alphanumeric pages from within Microsoft Exchange, Windows Messaging, and Outlook to a recipient whose pager information is stored in the contact databases of those applications.

If you find yourself sending multiple pages and want a way to get organized, HotPage may be just what you need.

HotPage 3.0. Street price: \$40. Requires: 8MB RAM, 1.5MB hard disk space, Windows 3.1,



CALLING: Select a graphical symbol for each person in your HotPage Desktop phone book.

95, or NT. Smith Micro Software Inc., Aliso Viejo, CA; 800-964-7674, 949-362-5811; www.smithmicro.com; 412 at www.pcmag.com/infolink.

DOCUMENT MANAGEMENT

Put Your Files Online

LaserFiche's WebLink makes it easy to post reams of printed documents to the Web or your intranet.

By James Karney

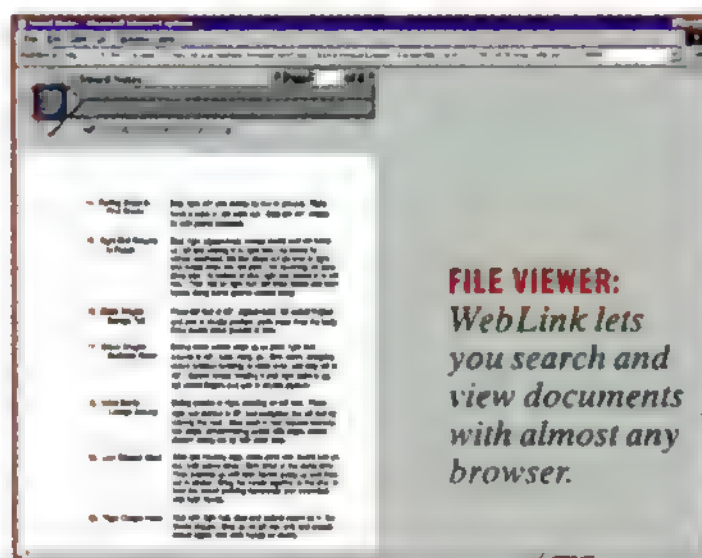
Need to put vast amounts of information on the Internet or an intranet and have a generous budget? Check out Compulink's WebLink, an online front-end to its LaserFiche Document Imaging System.

WebLink converts paper-based documents to Web-ready pages, with full-text search capability, without requiring special viewing software or browser plug-ins. Up to 17,000 documents will fit in 1GB of space. A SOHO solution this isn't:

The full package with the required LaserFiche Server (Windows NT or NetWare version), client-input software, and ten licenses costs \$16,995 (list). (WebLink alone is \$7,995.)

The process: Files are scanned with the client software and are automatically processed, stored in both TIFF

image format and in indexed full-text versions, and then added to the WebLink site. The LaserFiche Server manages the database. When someone visiting the Web site requests a file,



the graphic is converted on the fly to a GIF image.

The package is a dream to use. We loaded a variety of documents as fast as the scanners could process the jobs. As soon as a new file was processed, it was available on the Web. WebLink comes with standardized Web pages for accessing, searching,

and viewing documents, which can be reformatted on the fly for full-page printing, so setting up the site is all but automatic.

WebLink's installation is not for the timid. You have to create directories manually, copy files, and edit an .INI file and the Windows NT System Registry based on the documentation's examples. We took over 90 minutes to configure the package, including the LaserFiche Server and Client, and to set up two scanners on a Windows NT 4.0 Server and a Windows 98 client.

WebLink is an extremely powerful tool, well-suited to posting large libraries of information into browser-viewable repositories in a hurry.

LaserFiche WebLink. List price: \$7,995 (bundled with LaserFiche Server and 10 clients \$16,995). Requires: 64MB of RAM, 10MB hard disk space, Microsoft Windows NT Server. Compulink Management Center Inc., Torrance, CA; 800-985-8533, 310-793-1888, www.laserfiche.com; 413 at www.pcmag.com/infolink.

Step into our CareFree Night Life



Are nights and weekends off hard to come by? Is it because the amount of personal vigilance your server requires makes it difficult to get away?

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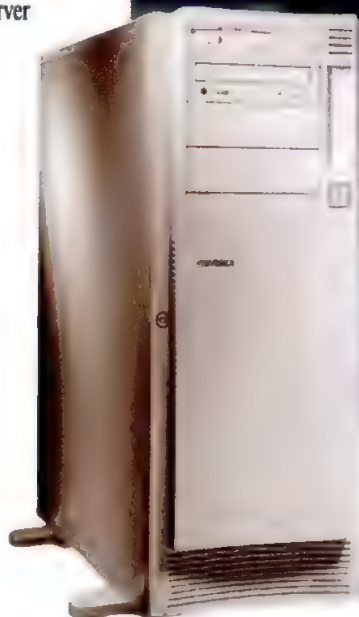
This is the Everex StepServer™ DS, the newest departmental server from Everex Systems. Not only does it have dual, hot-swappable power supplies, and RAID capabilities, but there's something really special under the hood. Each Everex StepServer™ DS comes equipped with ESMPro™ software and the Everex EV2701™ Server Management Board. With it you can status temperature, reset the server, check the hard drive capacity, or even see if the CPU cooling fan is operating. The best part is you can do this from home.

That's right.....from home.

But we don't want you to sit around at home watching your server all night either! If there's a problem we'll page you. Actually we won't page you, your server will. You got it! The server will page you. At home. On the golf course. In the night-club...well...you get the idea..

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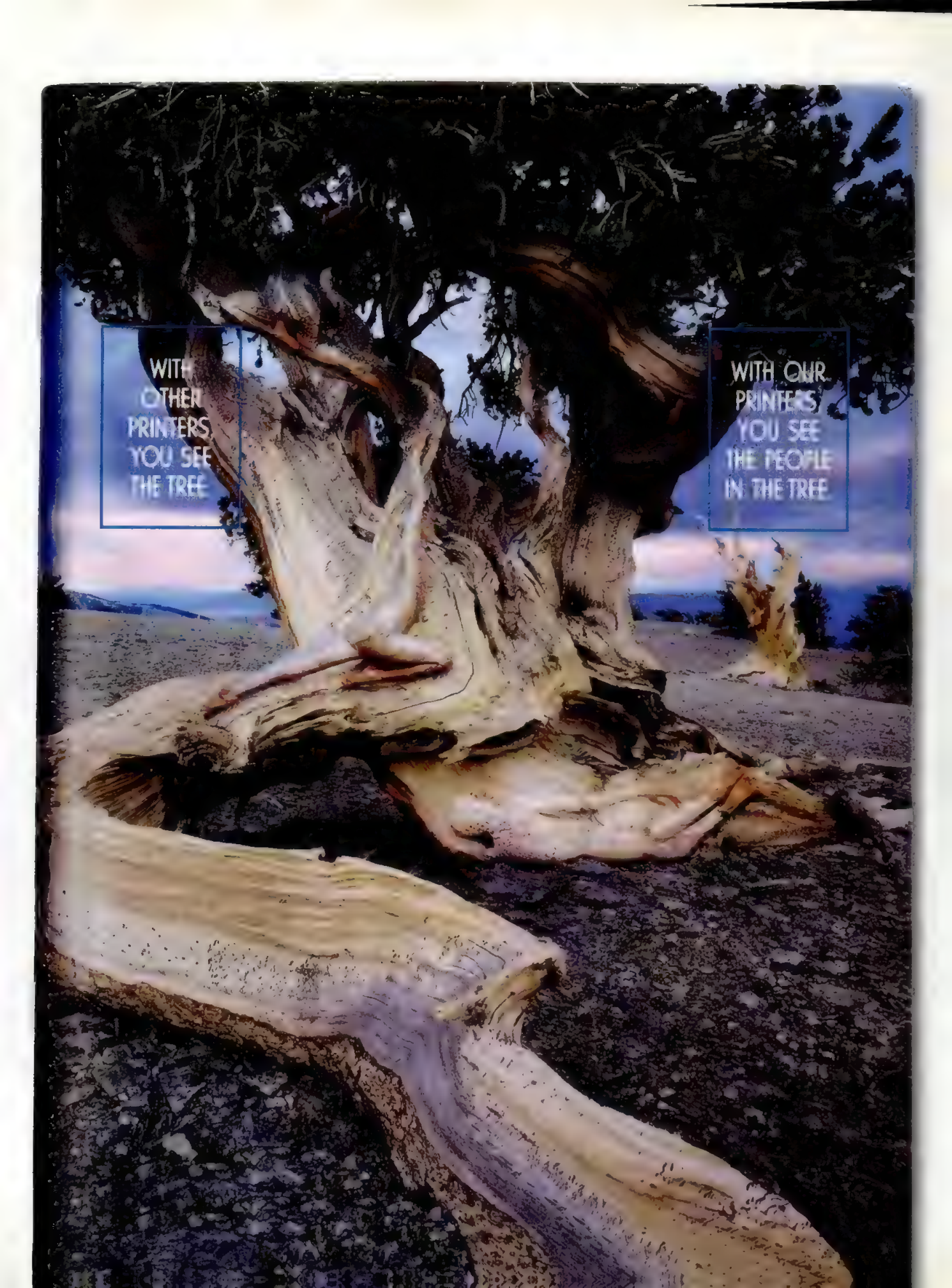
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A large, gnarled tree with a hollowed-out trunk, set against a sunset sky. The tree's trunk is thick and twisted, with a large opening in the center. The bark is light-colored and peeling in places. The background shows a sunset with orange and pink hues. The ground is rocky and uneven.

WITH
OTHER
PRINTERS
YOU SEE
THE TREE

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Second Looks

APPLE G3 POWERBOOK

Apple's Best Notebook Ever

By Daniel Grotta and Sally Wiener Grotta

We weren't surprised by the controversy and criticism from Apple aficionados generated by our First Looks Online review of Apple's new G3 Powerbook. As proof of our assumed Apple-bashing bias, a number of readers challenged the system settings we used on the Powerbook during testing.

Apple's OS8 (the basic code dates back to 1984) is, paradoxically, simple and efficient, but it is at the same time a frustrating interdependent operating system that requires the user to balance or tweak a number of parameters manually for optimum performance. These include OS overhead memory, program memory, cache memory, turning on or off AppleTalk, File Share, Virtual Memory, and RAM Disk, among other things. An inaccurate setting of one or more parameters can degrade performance.

We contacted Adobe, Apple, and Microsoft to confirm the optimum settings they had recommended for our tests. Apparently, there was a miscommunication with Adobe that resulted in our assigning Photoshop all but 1MB of total RAM rather than 1MB less than available RAM.

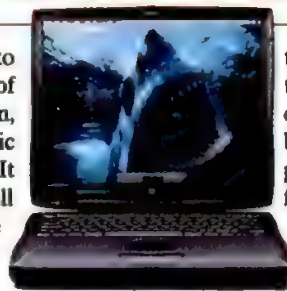
For our Second Looks tests, we changed the parameters to Apple's recommendation by assigning Photoshop 50MB of RAM and by turning off Virtual

Memory, AppleTalk, File Share, as well as hiding the Control Strip. Since all functions applied to our 10MB TIFF file occur in RAM, both Adobe and Apple told us the Disk Cache setting was immaterial. Adobe's recommendation was identical to Apple's—except for Photoshop RAM—which we increased to 51.4MB. We also tried two readers' suggested settings for maximum performance.

Microsoft, too, changed from the settings recommended in the programs to allotting more

RAM. According to a representative of Waggener-Edstrom, Microsoft's public relations agency, "It is really hard to tell someone what the 'optimal' settings are, since it depends entirely on what you do." To be generous, we adjusted the overhead RAM to assign Word 19MB and Excel 16MB.

The new settings generally produced an across-the-board performance improvement that ranged from slight to significant. Only one test (Resize) fared marginally poorer than our original settings, matching or beating



the PC in all Photoshop tests except Rotate, thereby confirming Apple's claim of platform superiority in Photoshop. Although all Excel and Word

times improved by assigning more applications memory, the Powerbook's performance still lagged far behind that of the PC.

Our conclusion? The G3 Powerbook is Apple's best, fastest laptop ever, but any advantage of one platform over the other is dependent upon the application.

UMAX VISTA-S12

No Scans Above 300 MHz?

By David Haskin

We have usually found UMAX Technologies' scanners to be top-notch—the company's Vista-S12 unit was an Editors' Choice in our issue of March 4, 1997. But if your UMAX scanner uses



a version of the company's VistaScan driver prior to Version 3.0 and if your PC's clock speed is 300 MHz or faster, Windows may not be able to load.

We discovered the problem when connecting a UMAX Vista-S12 to a 400-MHz Dell Dimension XPS R400 PC. The S12 is no longer in production but, like most UMAX consumer-level scanners, it uses the VistaScan driver. Windows 98 refused to load after we installed VistaScan 2.3 and displayed the message: "Cannot find or load vmm32.vxd." This refers to a virtual device driver that manages virtual memory, but an examination of our system found that the driver was

where it was supposed to be.

VistaScan 3.0 solves the problem, and the virtual device driver should be available for download by the time you read this. In addition, a technical note in the FAQ section of the UMAX Web site (www.umax.com) describes the problem and offers a patch for older VistaScan drivers. A company technician also provided a workaround, which we tried, that requires you to remove a line placed by the VistaScan installation program in the System.ini file.

We still encountered an error message when we were starting Windows, however, that said the operating system could not find another virtual device driver, enable.vxd, which helps manage virtual memory. After removing a line in System.ini that refers to that driver, Windows 98 loaded and the scanner worked.

A spokesperson for UMAX said the problem relates to how some higher-speed systems use Windows virtual memory. This system-specific problem occurs only in a small percentage of cases, she said. Another unpleasant note was that we waited on hold for almost 2 hours before getting through to tech support.

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Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below, you'll see opinions from just two of the many people who told us how much they love Apple's Powerbook G3.

Apple G3 laptops rock! I have had my G3 250-MHz laptop for about a month now. I never thought I would purchase an Apple product. After this purchase, my next desktop will be an Apple! Speed, elegance, easy to use, it has it all. All die-hard Windows users should give Apples a try. They just might surprise you! Way to go Steve! Woo! Hoo!

—Brady MacDonald

An unbelievable machine! This is by far the most incredible computer I have ever used. Netscape launches in like two seconds and looks amazing on this huge, beautiful, 13.3-inch, millions of colors, active-matrix screen. Everyone who sees it says nothing short of WOW! It's a really good product at a really good price. Thanks, Apple!

—Jeff Roach

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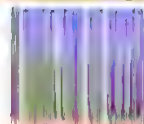


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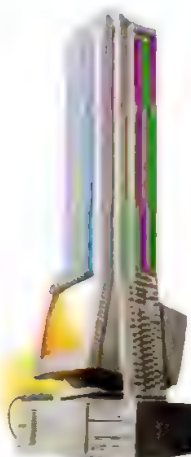
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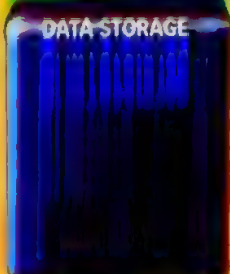
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Mind Your Manners

Momma always told you to be polite, to mind your manners in public, and to remember that two wrongs don't make a right. Mothers of all ages would be well advised to remind their progeny that the Internet is a very public place, and that what you do

there can have surprising, even drastic repercussions.

A few months back, I wrote several of my *PC Week* columns about Internet utilities. I started with a comparison of route tracers, which display the hops and calculate the delays that your messages incur as they move from your machine to a host site. Most of these utilities are freeware or inexpensive shareware, and I included links for readers to download the programs. I also warned that some of these programs had powerful features that required an understanding of Internet server administration and security, since exercising some of the features could be perceived as a cracking attack by site administrators. They particularly dislike it when you ping every server in a domain, sweep IP addresses, or sniff server ports.

Sure enough, one of my readers downloaded one of the more powerful programs and proceeded to demonstrate its features to a friend. He ran through various tasks, delighted with the program's capabilities. Without realizing what he was doing, he pinged every server in a .gov domain. Next day, his ISP canceled his account; the retribution was swift and uncompromising. When an ISP gets a call from the feds, you can be pretty sure that it's not going to bother asking for your side of the story. He has a different ISP today, so you might ask, "So what?"

Here's another case where the loss stung more. A person wrote me who is knowledgeable in the ways of business and technology, with credits as a book author, columnist, publisher, and former CEO under his belt. He's been active online for years, but he found himself in a flame war with another individual on a Usenet group. I've read some of the threads, and I won't comment on who's right and who's wrong. Their online dealings took on the flavor of two brawlers who had each other by the hair, each yelling "Let go!" or "No, you let go!" They made a passable attempt at a truce but continued to hurl fairly vile imprecations at each other during the negotiations.

Finally, one contacted the other's ISP, and the service provider canceled the writer's account. No big deal, ex-

cept that in this case, the ISP was the local cable company, which provided a high-speed RoadRunner connection. Ironically, the writer did not use his RoadRunner account for Usenet access, but the cable company canceled him anyway. The RoadRunner officials said they

were not at all interested in who was right or wrong; it just wasn't worth their time to listen to complaints, charges, and countercharges. The writer has tried to get his account reinstated, to no avail. He won't have another shot at high-speed access until some other service becomes available in his area. I haven't confirmed this, but it appears that the other combatant has had some service cancellations, too.

It's significant that a Usenet-based debacle had these repercussions. For many years, unmoderated newsgroups were a verbal free-for-all, and no one cared. The signal-to-noise ratio in some groups is so low that it's a wonder anyone frequents the groups for any reason other than to fight with other users—taking sides, flaming, and trolling for reactions.

But what goes around comes around, and justice and discipline are finally being meted out in some newsgroups. It's not too hard to falsify your identity, post under another user's name, or cancel others' messages. These are also quick ways to lose your ISP, because providers have become responsive to complaints and various bots monitor postings for consistency and fraud. Nobody says you have

to use your real name, but using somebody else's is becoming a quick trip to nowhere.

The best defense against bozos in newsgroups is good filtering—the kind provided by a top-notch news reader such as Forte's Agent. If people are determined to annoy you, however, you may have to resort to detective work to figure out who their ISPs are and get them squelched.

The best program for the job is Sam Spade from www.blighty.com. But do yourself a favor and read the directions first. Chances are, though, you'll never have a problem if you stay on topic, keep it civil, and resolutely resist the desire to put the jerks in their place. **PC**



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Microsoft Should Apologize

The September 1998 issue of *Brill's Content*, a new magazine that investigates the actions of the media/public relations complex, went after Microsoft's PR machine. While much of the information was nothing new, Elizabeth Lesly Stevens managed to reveal

some—but not nearly enough—of the dirty tricks Microsoft played to untrack OS/2. She did uncover the basic insincerity of the famous OS/2 war, though. That helped a little.

When OS/2 was still in contention with Windows four years ago, Microsoft took advantage of IBM's ethics and ran OS/2 off the road. According to Rick Segal, one of the forces behind the attack, Microsoft exploited IBM's policy barring employees from disparaging any competitor's product. Microsoft took a team of 15 so-called evangelists and went to online forums to trash OS/2. Steve Ballmer himself was taking OS/2 around to IBM booths to show how it crashes. This was an ugly period. The net result was untold riches for Gates and company and apparently a clear conscience.

I was an OS/2 user at the time and watched Microsoft destroy IBM's Dave Whittle, who was probably the only one at IBM to notice what was happening. He was also the only person from IBM who would stand up for the product. The kicker to this is Segal's quote in *Content*: "OS/2 was superior in every way at the time. It kept the machine from crashing. There isn't a Microsoft person on the planet—if they're being honest—who wouldn't say that absolutely. In pure architecture, OS/2 and its technology were better."

This highlights two pathetic aspects of this business: the incredible insincerity of Microsoft during this period (and what's changed?), and the more incredible gullibility of the computer-using "experts" who peopled those same forums and parroted Microsoft's propaganda as if it were gospel. In forum after forum you'd find these clowns jumping all over Dave Whittle and his lone voice trying to get people to look at OS/2 objectively.

Whittle was so frustrated that it cost him his relationship with IBM (which at the time was as dissociated from the user community as possible), and eventually he was forced to quit. Whittle should get a public apology from Microsoft. In *Content*, Segal gloats over how Microsoft decimated the guy online, claiming, "It's outrageous how IBM sent him in [to the online forums] with a pea shooter. We were going to cream him, pick him apart, slaughter him." What was unprecedented

ed about the OS/2 wars was that the flaming and personal attacks were done at a corporate level by Microsoft.

Of course you could also argue that by today's unethical standards and mean-spirited, warlike approach to business, Microsoft did what it did because that was the company's job.

But IBM did nothing to help Whittle. Meanwhile, the stooges and lackeys in the forums made Whittle's life miserable, as they were even more vicious than the Microsoft employees and aliases.

What bothers me most about online forums and these feedback systems is the ease with which ignorant and stupid people can be heard—the Jerry Springer phenomenon. These are unthinking, uncaring, hurtful people who are self-centered and vindictive. I'm always amused at how many people come out of the woodwork when you criticize a piece of equipment and they think you're criticizing them. They feel it's okay for a personal attack.

Whittle, who was arguing the pros and cons of operating systems, was personally attacked over and over. I suspect that in the not-too-distant future, both the person who posts a message and the forum where the message is posted are going to get sued for libel and these posts will end. There have already been a couple of minor actions that have been largely ignored. It's just a matter of time, I guarantee.

Unfortunately, *Content* fails to dig deeper into the ethical and moral situationalism at Microsoft then and now. Worse, Stevens quotes to death the current

corporate spokesperson, Mich Matthews, in order (I suppose) to balance the piece with the Microsoft view. Most if not all of Matthews's insuperable and sometimes ridiculous flak-job comments go unquestioned. For example, Matthews tried to explain the Microsoft evangelism strategy, concluding with the comment, "This is why we have evangelists. And so, these days, does Apple." Hey, lady, Apple invented the idea! Microsoft had two in 1987. Apple had dozens in 1984. This is yet another attempt by Microsoft to rewrite history and sneak it into *Content* as an unchallenged fact. These guys never quit, and even the supposed watchdogs can't handle the onslaught of baloney. Unbelievable.



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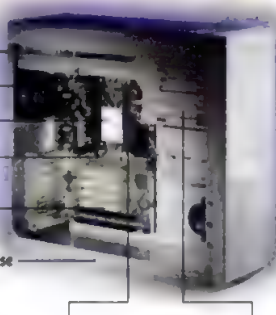
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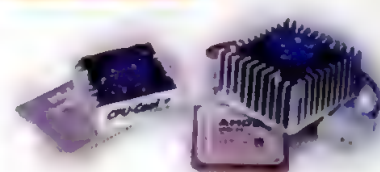
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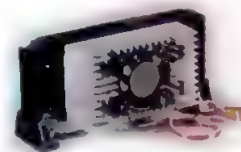
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Inside Track

Confusing the Issue Dept.: After a poor showing by the first Celeron chips, Intel has added an on-board L2 cache and turned the Celeron into a performer on a par with the Pentium II at the same 300- and 333-MHz clock speeds. Unfortunately for consumers, there's both a good and a bad 300-MHz Celeron; the good (read *fast*) Celeron will be designated the 300A. The 266-MHz Celeron is a hopeless pig and will be phased out.

It's nice that Intel bothered to fix the performance of this new line of chips, but you have to wonder whether anyone will care. **The chip is already tainted** in the minds of savvy buyers, and making things more complicated with the 300A designation won't help. The original 300-MHz Celeron doesn't have the performance of the 233-MHz Pentium MMX, and the marketing for this line of chips was poorly thought out. **The irony** is that if Intel had used a performance rating, the chip would have scored lower than actual clock speed—an industry first!

Intel is obviously **panicked** by current market conditions and has awoken to the reality of the cheap computer, something about which it was in denial. Thus, still another marketing experiment is headed our way: the Whitney (north bridge), an integrated support chip and i740 graphics processor. While *Microprocessor Report* chides Intel for the decision, it's missing **the real intent**. Intel eventually wants to combine the graphics processor and north and south bridges and then add a processor to head toward its version of **the computer-on-a-chip**, which appears to be the big push in the industry. The Whitney is just a step in that direction.

In the same issue of *Microprocessor Report*, there was a **curious news item**: Apparently a boosted 450-MHz AMD K6-2 (the chip was cooled with a KryoTech cooler) running a software package called Rebel has **beaten the number-two chess player** in the world, Vishny Anand. It appears that all the work going into IBM's Deep Blue won't be necessary as we move toward the gigahertz PC. But this is hardly the **killer application** chip makers need to get people back on the PC-upgrade treadmill.

Watch Out for the Black Helicopters Dept.: I don't know about you, but to me the idea of putting GPS units into cell phones to broadcast your exact location in emergencies seems to be a potentially onerous use of technology. It's predicted that within a few years, half of all the cell phones sold will have this capability as part of the FCC mandate concerning 911 services.

Windows CE—Watch Dept.: I've been watching the Windows CE—versus—PalmPilot battle as Microsoft and its partners attempt to unseat the Palm platform's lofty perch. Every time I meet with a company promoting the Win CE

*It's nice that Intel
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platform, one thing becomes clear: **Microsoft is hurting** its chances with **dubious edicts** that licensees must follow. This is obviously a throw-back to the onerous licensing agreements reluctantly signed by desktop makers and under investigation by the government.

Looking at one of these Win CE units, I notice that the screen is **just plain hard to read**. It's noticeably harder to read than the PalmPilot's screen. Apparently, Microsoft requires that the screen use four scales of gray, period. Gray scale on these things is **a joke**. The Palm is monochrome.

This is **one of the many Micro-**

soft caveats and requirements that will keep Win CE from being a contender. But the biggest problem with Win CE is the fact that it's **not running on a single chip family**. Win CE runs on various chips. For some reason the reviewers don't stress this problem, and the public has yet to realize it.

On the other hand, Win CE machines are showing a lot of creative possibilities for hand-held devices. Look for **built-in voice recorders and cameras** as well as other features not found on the current PalmPilots.

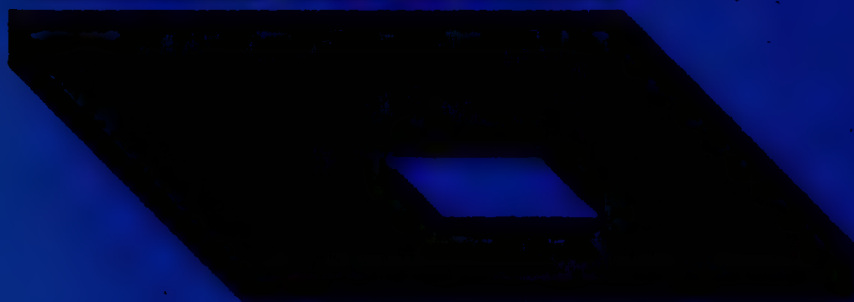
Genuinely Interesting Hardware Dept.: Over the years, many of us have used various Xircom products for one thing or another, usually to hook a network to a laptop. I was having various problems getting my IBM 560X to work properly with these PC Cards and was **getting frustrated**. Along comes the cool Xircom RealPort, a 10/100 Ethernet card combined with a 56K modem. My IBM 560X seems to accept CardBus cards, but I've never gotten one to work right, so I'm using the 16-bit PC Card version of this Xircom card. It works great, giving me 100 Mbps on the network and 56K capability over the phone.

What's interesting is the fact that the card incorporates the connectors in the side of the unit, so **no dongles are needed**. It requires two slots but is hot-swappable. More important, it sets up and runs with almost no effort. The card retails for under \$400; IBM 560X, users take note. Xircom claims that later this year a **software download will allow the card to make ISDN connections**. I'll be interested in seeing how that works!

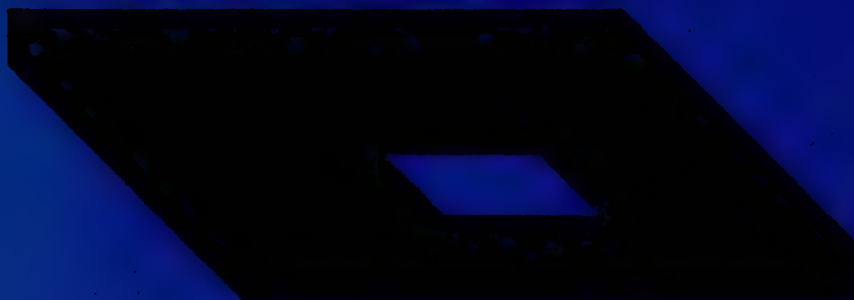
Genuinely Interesting Software Dept.: One of the most interesting photo-stitching programs I've seen recently is QuickStitch, from Enroute Imagine in Mountain View, California (800-946-0135, www.enroute.com). This kind of software takes multiple electronic images and stitches them together intelligently to make bigger pictures or panoramas. I've seen various programs do this but **none so impressively**. Multiple pictures of the same image can also be combined to produce a much-higher resolution version of the same image—truly unique! It's \$39.95 and highly recommended. If you have a digital camera, **you want this!** 



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and the CRTs stay on our desks.

Insider tip: I think LCDs are going to push that glorified TV set off your desk a lot faster than you may expect. Several factors have begun to come together to tighten up the time line on widespread adoption of LCDs. And three outstanding new LCDs, in varying sizes and across a wide range of prices, are going to be this year's standards against which all other LCDs will be measured.

The success of notebook PCs over the last six years or so has been a big factor in pushing LCD quality and size up and prices down. As we've moved from 8.4-inch LCDs in notebooks up to today's 14.1-inch and 15-inch units, not only have prices fallen but the gap between the kind of display you really want—a bright, crisp active-matrix panel—and the flock of other, wanna-be technologies has narrowed sharply, too. Not so long ago that difference was \$1,000; today it's just \$200 to \$300.

The huge demand for LCD panels for notebooks has increased production, in turn driving down unit costs as well as funding research on new, cost-cutting production methods.

Our growing interest in energy conservation is also a force in the move to LCDs, because they consume less energy and throw off less heat than CRT monitors do. Over time, those savings add up and make us feel green.

We are also far more sensitive to the human-factors design of computers today. The case for eye damage from radiation emitted from CRTs is far from proven, but I know one way to eliminate that worry: LCD monitors. They have sharper images, fewer reflections, less glare, and no flicker, all of which contribute in very real ways to PC users' comfort and health.

The three units available today that will accelerate LCD adoption range from a glorious 20.1-inch unit at the high end to a superb, more affordable but still expensive 18.1-inch unit to a 14-inch all-digital display system (maybe the most dazzling of all) at a rock-bottom price.

At the top, the 20.1-inch NEC MultiSync LCD2010

remains the pace setter. It's big, bright, sharp, and a joy to work with, and it ought to be: Even though NEC (www.nec.com) recently chopped the price by almost \$2,000 to about \$5,500 (street), it's still way too expensive for most of us. But the LCD2010 defines the high end in function and quality—at a commensurate price.

In the middle range (but still pricey), I'm knocked out by the \$3,600 EIZO Nanao FlexScan L66 (www.eizo.com). This gorgeous 18.1-inch display just started shipping, and if you can find one grab it fast. This monitor gives the slightly larger NEC unit a run for its money, only at \$2,000 less.

The real mind-changer of this trio is the new Princeton DPP 500 14-inch display (www.prgr.com). Unlike most other desktop LCDs now on the market, it's an all-digital unit. Conventional LCDs for desktop use put the video signals through an analog-to-digital conversion so they can work with the VGA cards already installed in PCs. That compromises contrast and sharpness but has been necessary: Who has a digital-output video card, anyway?

Princeton's answer is to bundle the excellent new ATI Xpert LCD digital video card with the DPP 500. This well-matched duo delivers the sharpest, crispest, contrastiest images I've seen yet on production-run LCD—at an astonishing price.

This year, people expected to pay \$1,500 for a 14-inch LCD. Princeton left the competition sucking air when it rolled out the DPP 500—plus—ATI Xpert bundle in late summer for around \$900.

Vendors have told me they didn't expect to see LCDs (let alone a true digital display, bundled with a great video card) at that price until next year. They scrambled to reprice their offerings to stay competitive, but Princeton has held its edge in quality and value.

I've been working with desktop LCD monitors for some time now, and I want to make a couple of points you'll want to consider as a buyer. First, inch for inch, LCDs seem bigger. Just as we perceive 13.3- and 14.1-inch



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notebook displays as so large they can be desktop replacements, I find that with LCDs, I can drop down a notch or two in display size from the CRT world and still feel I have plenty of screen real estate. I've replaced 19-, 20-, and 21-inch CRTs with the EIZO Nanao 18.1-inch display and come out ahead. Similarly, when I replaced existing 21-inch CRT displays with the LCD2010, it felt as if I had a bigger display than I had before.

This works with 14- and 15-inch LCDs, too, both of which seem to me sufficient for most desktop work, replacing 15- and 17-inch CRTs.

Second, some of the new LCDs rotate 90 degrees, so you can choose between portrait and landscape views. I like vertical-orientation monitors a lot: I used a Radius Pivot on a Mac for years and grew fond of seeing pages displayed as pages, not as white vertical rectangles floating in horizontal black rectangles with wasted space all around.

Rotation is going to become a common but not universal feature in LCDs over the next year. Perversely, I find it less important in the really big LCDs, such as the NEC MultiSync LCD2010 (which has rotation), than in, say, 14-inch units such as the Princeton DPP 500 (which doesn't).

Third, a prettier, sharper, more stable picture from a cooler-running monitor may not be LCD's biggest win for most of us. The biggest gain for me was clearing those huge, deep CRTs off my desk and regaining desktop real estate—the kind that's made of wood (or at least plastic laminate), not a computer screen's "desktop."

Especially as we start using Windows 98's support for multiple monitors, where physical display size becomes the limiting factor, LCDs are going to be prized as much for their smaller footprint as for reducing eyestrain and saving money on energy bills.

You may not be ready to buy a new LCD today or tomorrow. Conventional wisdom has it that flat-panel displays won't take off until their prices hit the 1.5 $\times$ level, costing only 50 percent more than CRT units. With \$150 15-inch and \$350 17-inch CRTs in abundance today, albeit with much lower image quality than a typical LCD panel, we're still some distance from that point.

But I think the "not until 1.5 $\times$ " crowd is going to be proved wrong. You and I and the people who buy the PCs we use at work are going to catch on to the advantages of LCD desktop panels a lot sooner than some experts think. **PC**

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Portrait of an Industry

Ten quick observations on the PC industry: First, it's okay to buy Celeron. The just-announced 300A and 333-MHz Intel Celeron CPUs (code-named Mendocino) finally have a cache, albeit a modest one—128K, versus no cache for the initial run of

266-MHz and 300-MHz Celerons and 512K for a real Pentium. Bolstered by cache, you now won't be laughed at by friends for buying Celeron. If you're looking for a fast, low-cost PC, the AMD K6-2 is a good choice, too.

News item: Dell outsells Compaq. It was U.S. desktops last quarter, not total worldwide sales, and just-dethroned number-one Compaq is strongest in the holiday season. Still, who would have imagined this two or three years ago? Reseller-oriented vendors (Compaq, Hewlett-Packard, IBM) are trying to be more direct, with Web sites that let big accounts order PCs directly (and then take delivery via a dealer), direct sales of refurbished PCs, and even some direct sales of new systems, albeit at prices that won't undercut local channels.

What if retail up and went away? Retail stores are a fine place to buy a box of floppy disks, but your next PC? I'm not talking about local value-added resellers who actually know how to bring up a Web server or string together a 100-Mbps switched Ethernet LAN. I'm talking about the clueless local stores and chains that give you indifferent sales reps and less and less variety in PCs. Now get this: To offer "variety," some stores are putting in kiosks that let you punch in the specs of a system you want and then pick it up a week or so later. Help me understand: How's that convenient for the buyer?

Smaller, cheaper scanners, tablets. The new generation of \$100 flatbed scanners are little bigger than notebook PCs, because they use *contact image sensor* (CIS) rather than *charge-coupled device* (CCD) chips. Our testing at PC Magazine Labs indicates that this new technology offers mixed quality; it should improve over time. Look for prices to come down on many other peripherals, too. Some vendors predict that drawing tablets, for instance, will hit \$50 each by mid-1999.

Clueless e-mail continues. Recently, I've been getting press releases from vendors that take 350-word (one-page) releases and include their logos. The files inflate from less than 5K (text only) to 500K. It happens with interoffice memos, too. If your company has remotely connected users who get their e-mail over phone lines, this is a killer.

Double-click before you walk. If your toddler shows an interest in banging the keys on your computer, get a copy of JumpStart Baby (\$30 street; Knowledge Adventure, 800-542-4240, www.knowledgeadventure.com) or BabyWow (\$34.99 direct; BowWow House, 888-899-0798, www.babywow.com) for more focused fun and a bit of learning.

Buy vs. lease. We're seeing another stab at leasing and obsolescence-protection programs for individuals and small businesses, such as Gateway's YourWare and Micron's TechRefresh. You either buy the PC outright or lease it, then trade it in 12 to 48 months later, depending on the program. As with car leasing, there are pros and cons. Read the fine print: "APR as low as 14.9 percent" can mean "up to 25 percent." Also, this is what the auto industry calls an *open-end lease*: The trade-in value is set at trade-in time, not now, and it's the wholesale value. For some people, this does let them get more PC than they could afford to buy outright.

Great deal: like-new PCs. If you want the most bang for your buck, check out refurbished PCs. When someone returns a new PC, it can't be resold as new, even though it's as good as new in my book. Local computer stores have them; so do the PC companies themselves. You save 10 percent to 25 percent off the new-PC price. Some are actually new PCs made from overstock items.

Big desktop LCDs to die for. Desktop LCD panels are the future. The cost is sky-

high, but what you really want is an 18- or 20-inch panel with 1,280-by-1,024 resolution. In a big city like New York, where rents run \$50 a square foot per year, installing 15-inch 1,024-by-768 panels instead of 17-inch CRTs might let your facilities people get away with downsizing cubicles by 1 foot.

USB: two steps forward, one step back? We're finally seeing Universal Serial Bus peripherals. Some products are good; others have stability problems. A handful of simultaneous connections (2 or 3) is more likely now than the 127 allowed for in the spec. Accessory monitor hubs that should provide power don't have it. Et cetera. Let's hope it gets sorted out over the next few months. **PC**



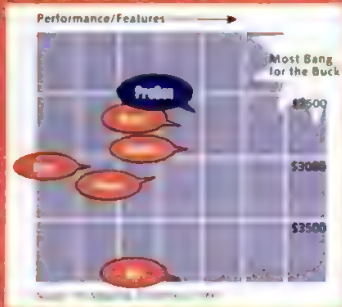
TO BUY OR LEASE?

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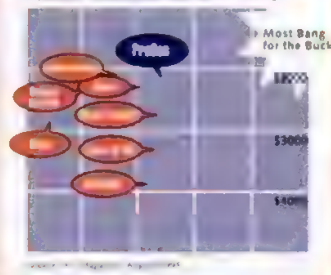
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BY GAIL SHAFFER

Software sneak preview

In this special **cover story**, *PC Magazine* editors give you a **glimpse** of the key products coming to your **desktop** in 1999.

Computer users can be divided into two camps. On one side are those who are satisfied with the current state of technology. They believe that PCs are fast enough and that today's applications are capable of doing just about everything we could ever want. On the other side are those who will always want more, which of course includes faster and more capable PCs. But mainly, it has to do with today's software, which has barely scratched the surface.

In case it wasn't obvious, here at *PC Magazine*, we fall into the latter category. We're always looking for new applications that can do more, make things easier, or just push the envelope a little. Fortunately, the people who make software happen to agree with us on this point. No sooner are new applications out the door than most companies are laying plans to improve on them. That is what this story is all about. Rather than testing shipping products, we decided to take a look at what's in store for 1999 in the major software markets. If you're anything like us, you'll be thrilled with all the changes in the works.

We kick off our coverage with a survey of the action in desktop and server operating systems. Despite its moniker, Micro-

soft Windows 98 should shine out in 1999, as its vendor releases updates that enhance the operating system's multimedia capabilities, and as hardware peripherals catch up to built-in standards. After a long wait, we should finally get Windows NT 5.0 in mid-1999. This major upgrade will have a big impact on both the desktop and server sides of the business world.

Naturally, we've got a piece for you on the big three office suites. Corel, Lotus, and Microsoft keep coming up with ways to make suites better by adding new Web features, integrated speech recognition, and much more. And we've got some details on what to expect in Microsoft's Internet Explorer 5.0 and Netscape Navigator 5.0 as browsers mature into essential productivity tools. In our Messaging and Groupware section, we preview the next versions of Lotus Notes, Microsoft Exchange, and Novell's GroupWise. Finally, because all work and no play can be dull, we wrap up with a look at the exciting games, children's titles, and home productivity packages on the horizon.

Though we know better than to suggest that you'll be completely satisfied—and we certainly won't be—we're sure of one thing: You won't be disappointed with the level of innovation in next year's software.

Desktop Operating Systems

This year belonged to Microsoft Windows 98, but next year it will have to share the spotlight with Windows NT. Although Windows NT 5.0 is not expected to arrive until mid-1999, this major upgrade is sure to have an instant impact on the business world. Microsoft has no plans for a Windows 99, but there'll be lots of action on that front as well when new updates and add-ons to Windows 98 arrive and hardware companies catch up to the advanced standards built into the OS. And lest you think Microsoft is the only game in town, others including Apple and the backers of Linux also have big plans for 1999.

Windows 98 hasn't been around long, but Microsoft has already started coming up with ways to improve on it. All it takes is a quick visit to the Windows Update site to download and install a slew of new components and enhancements. Most notable are the multimedia updates, including the Windows Media Player and DirectX 6.0.

The **Media Player** handles a wide variety

and sound better. At the update site, you'll also find an updated Internet chat client, new fonts, and new desktop themes.

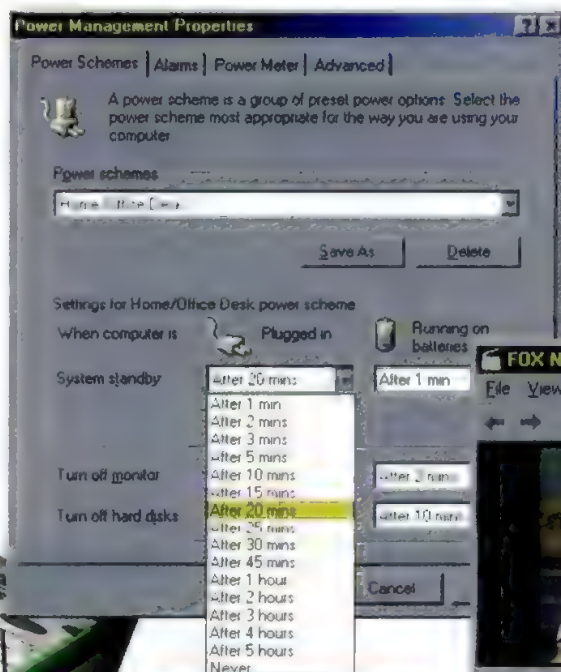
Building on DirectX, **Chromeffects for Windows 98** is an add-on that will do for Web sites what DirectX is doing for games. Chromeffects will enable Web pages with rich 2-D and 3-D graphics, sound, and video; and you won't have to wait forever

for applications and multimedia titles.

When we reviewed Windows 98 ("Windows 98 Put to the Test," August 1998), we found that much of its promise lay in exploiting new, advanced hardware standards. Unfortunately, hardware peripherals based on those standards have yet to hit store shelves. But in 1999, scanners, keyboards, and hubs based on Universal Serial Bus, and digital video cameras and storage devices based on IEEE 1394 (or FireWire), should become more common—making installations significantly easier.

Windows 98 supports a more sophisticated power management scheme called ACPI (Advanced Configuration and Power Interface) that should not only squeeze more life out of your notebook batter-

◀ **HARDWARE** companies should catch up to Windows 98's improved power management in 1999. ▼ The new Windows Media Player.



◀ **Chromeffects** SHOULD give a whole new dimension to Web pages.



of audio and video formats. You can use it to catch up with the latest on Fox News, check on the Dow with Bloomberg, or view scenes from *Casablanca*. A controversy has erupted over conflicts between Media Player and RealNetworks' players. But these conflicts occur only in rare instances, and it is not clear who's most to blame. The **DirectX 6.0** multimedia platform will make computer games look sharper, run faster,

for them to download. Web site developers can use Chromeffects, for example, to map HTML text and images to the surfaces of a cube. Due about the end of the year, it will also be used to create graphical interfaces

ies but also let your computer wake up instantly. No more twiddling your thumbs while booting up. New systems with Pentium II chips support ACPI, but older ones will need BIOS upgrades, and

OUR CONTRIBUTORS: GAIL SHAFFER is an executive editor of *PC Magazine*. DAVID CHERNICOFF is a freelance writer. BEN Z. GOTTESMAN and LARRY SELTZER are technical directors, DAVID LIDSKY and JENNIFER TRIVERIO are associate editors, and DOUG BEIZER is a staff editor. Associate editor JOHN MORRIS was in charge of this story.

applications must be updated as well.

You may think there's a lot going on with Windows 98, but it pales in comparison to what's in the works for **Windows NT 5.0**. Microsoft recently released a second beta that provides a fairly complete picture of what NT5 will look like when it ships in mid-1999. Expect to see a third beta in early 1999.

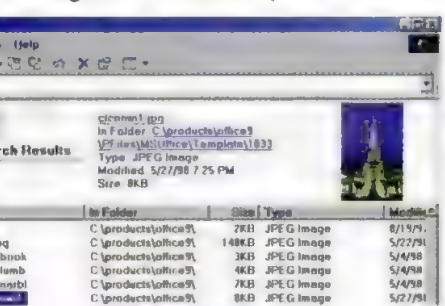
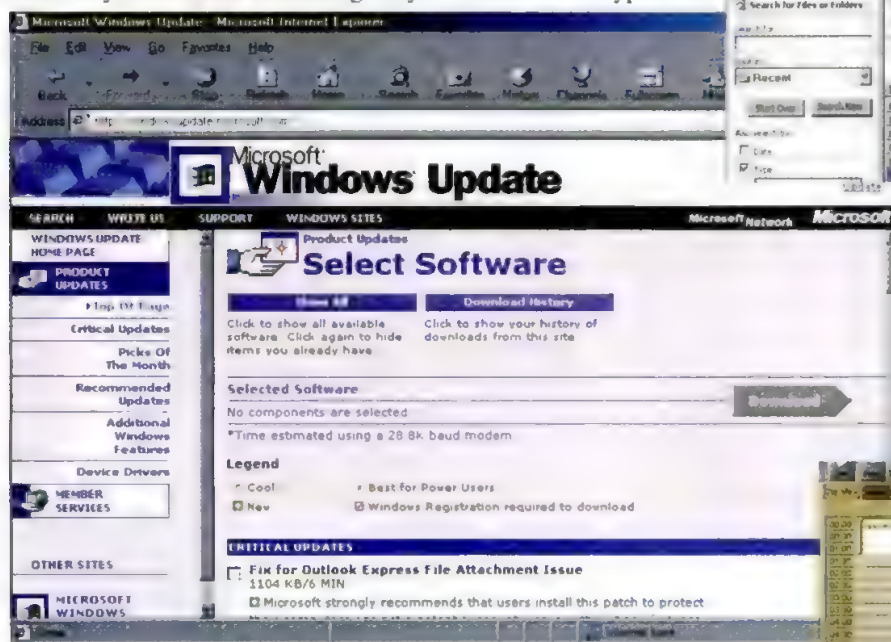
One of the most significant changes in NT5 is the creation of a new directory service, the tool that keeps track of everyone and everything attached to the network. That may sound like something only a

network administrator would care about, but it will also have a big impact on end-users. Because all the servers, files, and printers will be organized according to your company's structure (departments, workgroups, and so on), it should be much easier for you to find things.

One of the most appealing aspects of NT5 for end-users is that it should include many of the features we're accustomed to in Windows 98. This includes support for Plug and Play, the Win32 Driver Model, and hardware standards such as USB and FireWire. New hardware wizards will make it easier to install all types of

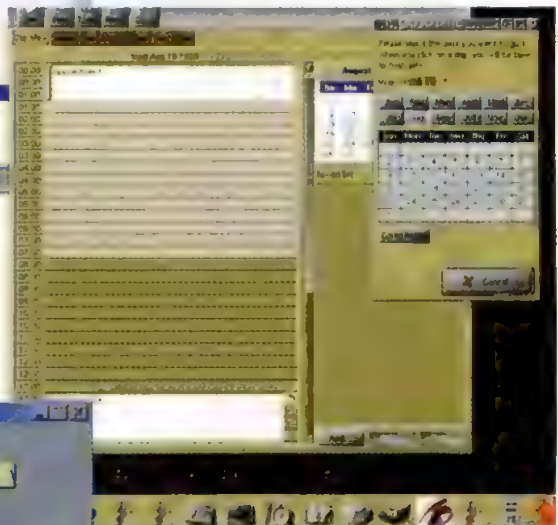
endary operating system made its debut about 1984. Slated to ship during the summer, **Mac OS X** (pronounced "OS ten") will for the first time let you work in several programs at once without running into stability problems.

Linux is popular among developers and widely used on servers, but the formidable OS has never attained a mainstream following. The **GNOME** (GNU Network



▲ **THE UPDATED CLIENT** in Windows NT 5.0 includes many enhancements such as this file finder utility that can search by date, file type, size, and other attributes.

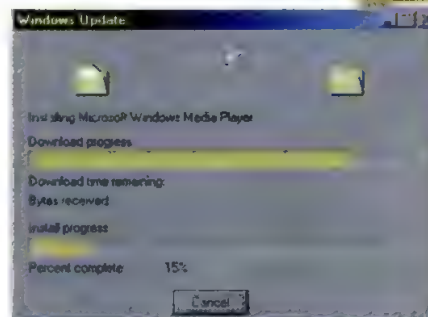
▼ **THE GNOME** project is putting a friendlier face on Linux in an effort to broaden its appeal.



network administrator would care about, but it will also have a big impact on end-users. Because all the servers, files, and printers will be organized according to your company's structure (departments, workgroups, and so on), it should be much easier for you to find things.

It will also be much easier for Windows NT to find you, thanks to new features designed for roaming and mobile users. By using Microsoft's **IntelliMirror** technology, NT5 can store all of your desktop preferences, applications, and files on a central server. So when you log on to a different system, it will seem as if you were sitting at your own desktop PC. Furthermore, if you use a laptop, you can cache all of this information locally, work off-line, and resynchronize with the server when you get back to the office. Since everything is on the server, you always have a backup if your data becomes cor-

▲▼ **THE NEW WINDOWS Update** site scans your system and automatically downloads and installs patches and new components.



rupted or your notebook is swiped. And with Windows NT's new transparent file encryption, you don't have to worry about information getting into the wrong hands.

Next year will also bring the first major changes to Apple's Mac OS since the leg-

Object Model Environment) project is seeking to change all that by developing a universal interface for Linux. But convincing Linux loyalists to embrace it may be the hard part.

IBM has been positioning **OS/2** as a twin-client platform. Its Workspace On-Demand can boot the OS/2 client directly from an OS/2 Warp server. The client can run 16-bit Windows DOS, and Java applications.—Larry Seltzer

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Server Operating Systems

Major changes are afoot in network environments for the remainder of 1998 and beyond as the two major players, Microsoft and Novell, release significant upgrades to their server operating systems.

Microsoft, with the introduction of its first directory service, has the toughest row to hoe—having to integrate all of the product's new features with a new directory. Microsoft is also seeking to prove that Windows NT 5.0 can play at the enterprise level and integrate well with other enterprise applications. Meanwhile, Novell has the somewhat easier task of integrating its new features into an already stable and mature directory service. But weaning its users away from the IPX/SPX network protocol and toward

► **NOVELL's NetWare 5** includes a new Java-based management console called ConsoleOne that includes NetWare and NOS tools and is extensible.

▼ **With NetWare 5**, Novell embraces TCP/IP as its native protocol.

security, centralized management, and better hardware device support.

Perhaps the single most significant change in NT5, from an administrative standpoint, is the new directory service. The current Domain model will be replaced by Active Directory, Microsoft's first attempt at a true directory service. A directory service keeps track of all the resources on a network (users, files, printers). With Active Directory, all the resources are assigned to logical departments or workgroups so it's easier to manage. In addition,

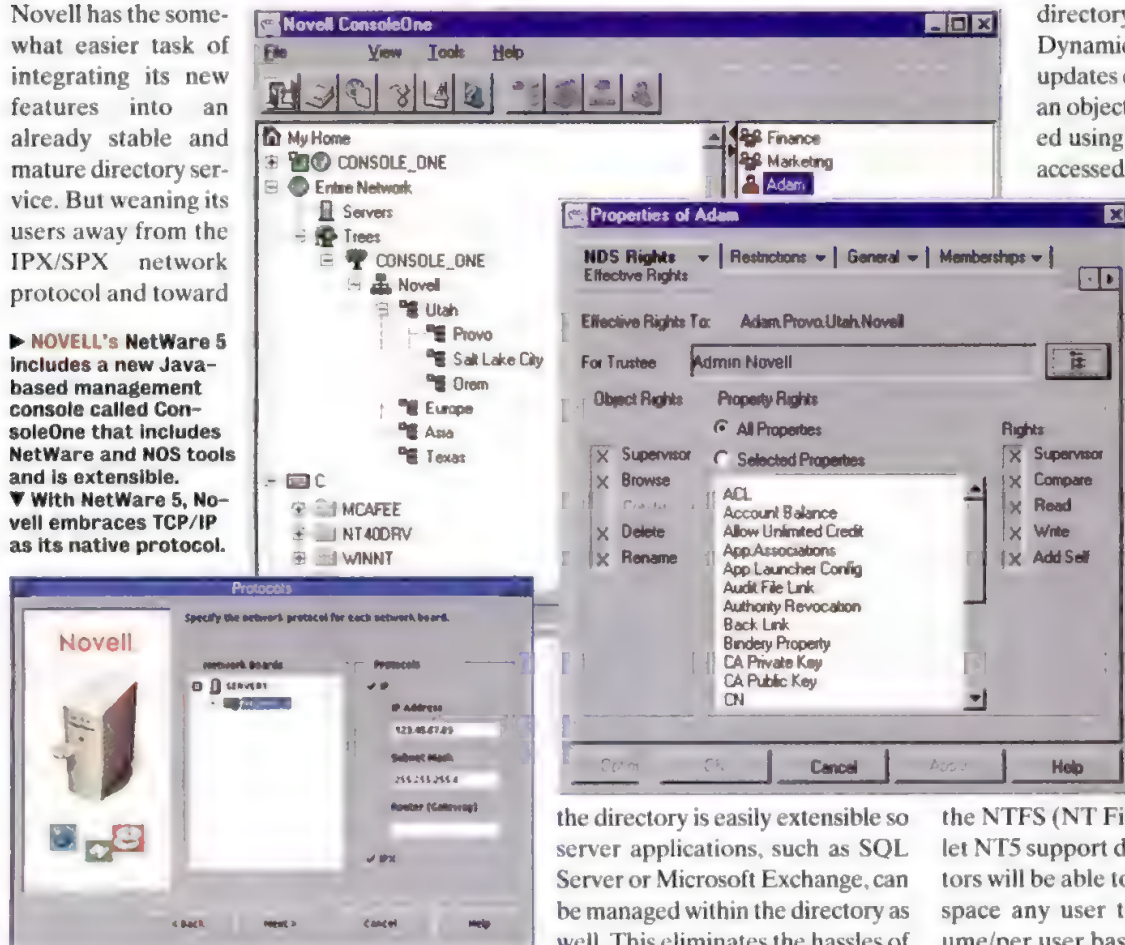
users and their client PCs. Policies are used to determine which users need what operating systems and applications. All of this information is stored on a central server so client PCs can be updated automatically without any intervention by the administrator. If you want to install Microsoft PowerPoint on all the PCs in your marketing department, for example, you just modify the policy. Applications can even be installed on the fly when a user receives a file type not supported by any of the currently installed applications.

To make Active Directory work, the network must be running TCP/IP as its core protocol, because the identity of objects in the directory is tied to IP addresses. For the

directory, Active Directory uses Dynamic DNS so that directory updates can be automated. Once an object in the directory is located using the Dynamic DNS, it is accessed via LDAP, NT5's native protocol for directory access.

NT5 will also deliver a much-needed security overhaul. The current NT LAN Manager (NTLM) authentication process will be replaced with an authentication methodology based on MIT's Kerberos security model. This shared-secret security offers a much more secure authentication environment than the current model does.

Modifications to



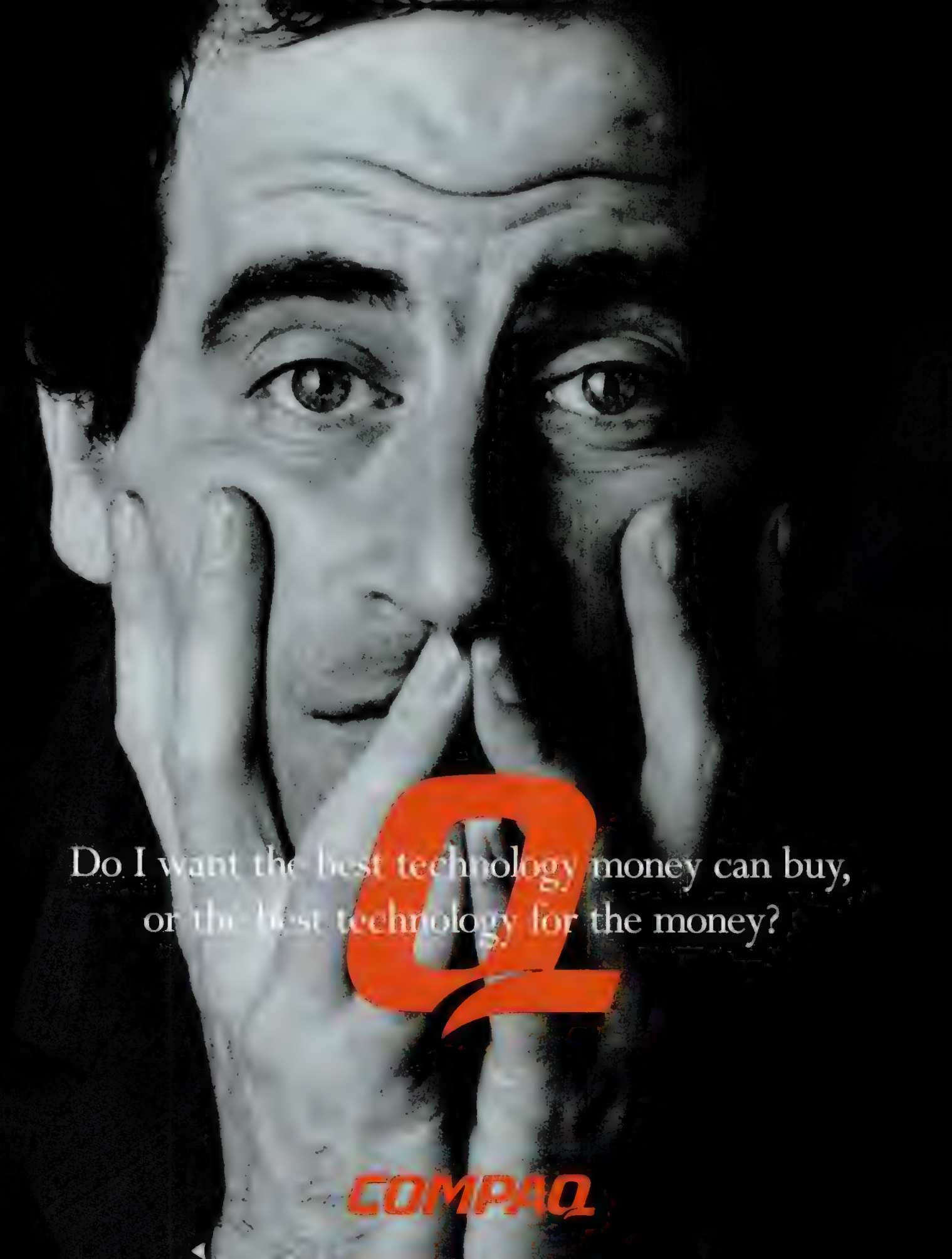
IP may be easier said than done.

Before **Windows NT 5** makes its debut, Microsoft will ship Service Pack 4 for NT 4.0, which contains some of the components initially slated for NT5. But most eyes will be on NT5, which will bring significant changes including a new directory, an updated file system with improved

the directory is easily extensible so server applications, such as SQL Server or Microsoft Exchange, can be managed within the directory as well. This eliminates the hassles of managing a network in which individual applications such as messaging solutions have their own directories. Other vendors such as Cisco are also working on products that will integrate with Active Directory to help manage network resources.

With NT5, Microsoft will continue to enhance policy-based management of

the NTFS (NT File System) architecture let NT5 support disk quotas. Administrators will be able to control how much disk space any user takes up, on a per volume/per user basis. NT5's Remote Storage (also known as Hierarchical Storage Management) allows the migration of seldom-used files automatically from hard disks to backup media. When a file is moved to tape, a shortcut remains on the network drive so that, when a user requests the file, it can be automatically restored. And support for Plug and Play



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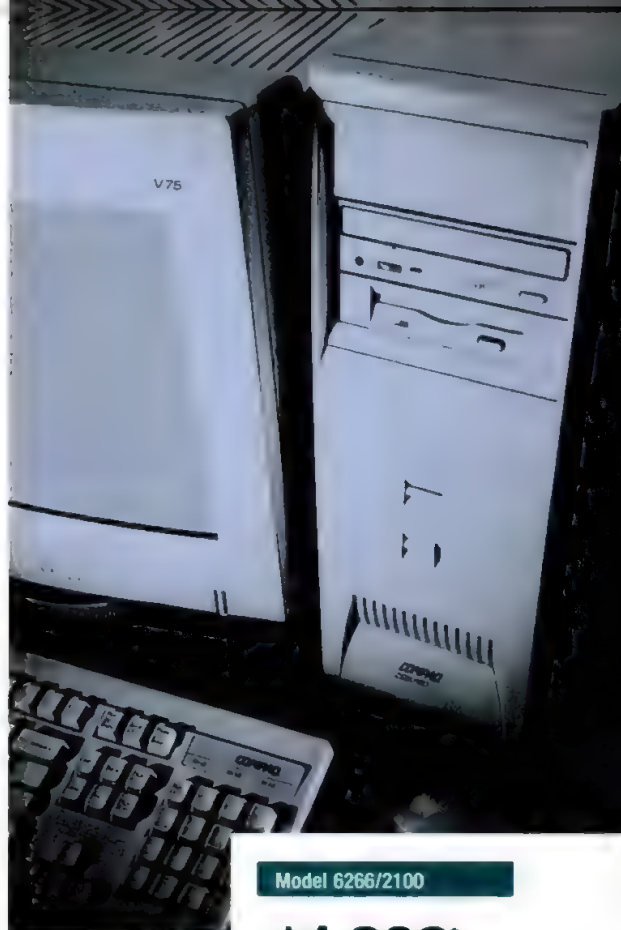
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means you can swap drives in a RAID array or modify disk partitions without taking a server down.

NT5 offers a unified interface for all Windows NT management tasks. Microsoft Management Console, first introduced with the NT 4 Option Pack, is a tool for managing services, applications, users,

based management so network managers can assign tasks to staff members. A truly significant change to NDS is that it will be fully compliant with LDAP, Version 4, so application developers will be able to write programs that directly hook information stored in the directory without requiring a proprietary programming interface.



and resources. Its snap-in architecture lets administrators easily integrate third-party management tools.

Though the litany of changes to NT5 is difficult to match, Novell's NetWare 5 will also be a significant upgrade. NetWare 5, which should be shipping by the time you read this, is an even more significant upgrade than NetWare 4.0, which introduced Novell Directory Services (NDS).

For years, NetWare has depended on IPX/SPX as its core transport protocol, giving it the network OS performance crown. But in NetWare 5.0, Novell is stepping away from IPX/SPX in favor of TCP/IP. Because TCP/IP is a more widely used network protocol (used in the Internet, for example), running NetWare on a TCP/IP network means you need only one protocol to connect clients to anything. Backwards compatibility is maintained for IPX/SPX and applications that require it.

Unlike Microsoft's Active Directory, Novell's NDS has been around for five years. NetWare 5 will offer an enhanced version of NDS that will support roles-

▲ **THE NEW** Microsoft Management Console (MMC) in NT5 is a unified interface for new administrative tools, including third-party tools. ▶ NT5 promises the same device support as Windows 98.

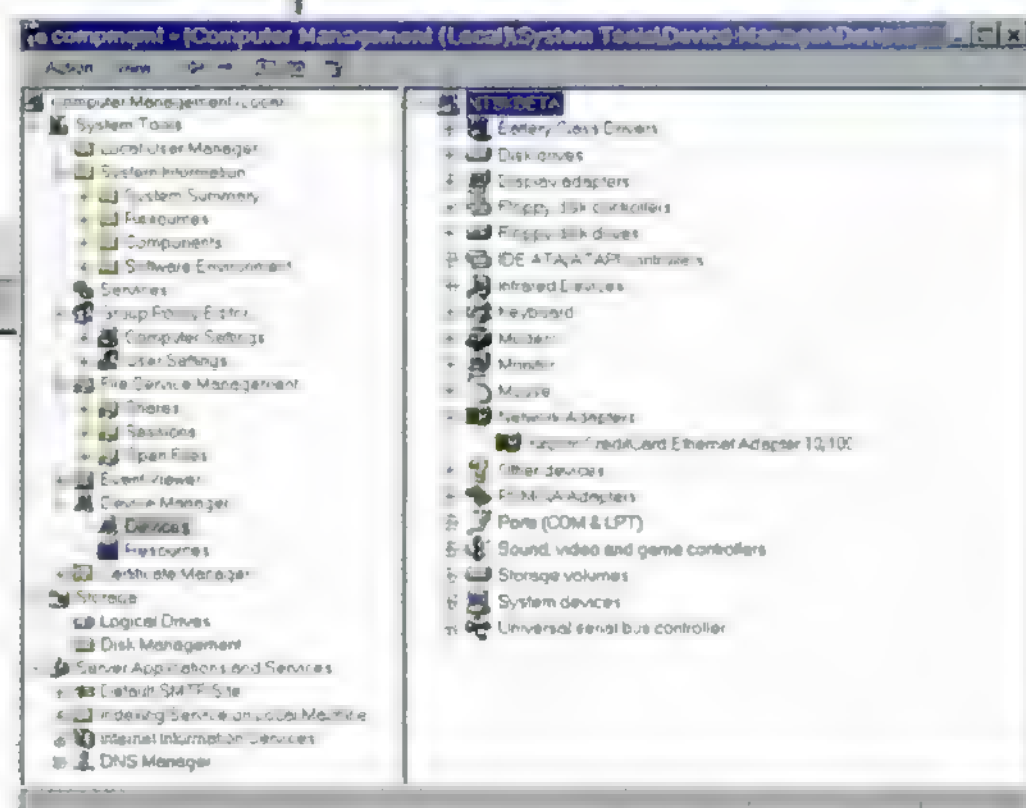
Like NT5, NetWare 5 has a unified management tool, called ConsoleOne. The Java-based ConsoleOne runs on any system with a Java Virtual Machine and includes NetWare and NDS administrative tools. A snap-in architecture will let Novell integrate BorderManager, GroupWise, ManageWise, and ZENworks.

Another key change in NetWare 5 is the introduction of Novell Storage Services (NSS). NSS is a 64-bit service that works in conjunction with the NetWare File System (NWFS) to provide performance and manageability improvements along with the capability to support single files as large as 8 terabytes and single volumes as large as 8 exabytes. This removes

any practical concerns over the size and number of volumes or files. One thing that will make NetWare administrators smile is that NSS allows any size disk volume to be mounted with 4MB of memory. This will make it possible to mount a terabyte volume in seconds. It will also allow for better utilization of memory by server-based applications. In addition, NSS increases the number of open files per server limit from 100,000 to 1,000,000.

This year's surprise contender for network operating systems is Linux. If we had to pick one development that really legitimizes Linux in the corporate world, it's the recent announcement that Oracle will port its Oracle 8 database to Linux. Informix has jumped on the Linux bandwagon as well. And application vendors such as Netscape and Corel have begun to move their application software to the Linux platform. There's even a version of NetWare from Caldera that runs on Linux.

Though no wholesale changes are



planned for IBM OS/2 Warp Server, an update to Version 4 should be in beta by the time you read this. Code-named Aurora, this new version combines all of the previous Warp Server 4 releases into a single package, simplifying distribution and support. This new version will also introduce a few enhancements, including a new Journaled File System that simplifies data recovery, the ability to manage Windows NT 4.0 servers, and support for the Intelligent Input/Output specification for SCSI and LAN devices. All told, Aurora is a good update for current OS/2 customers, but it's unlikely to win any converts.—David Chernicoff

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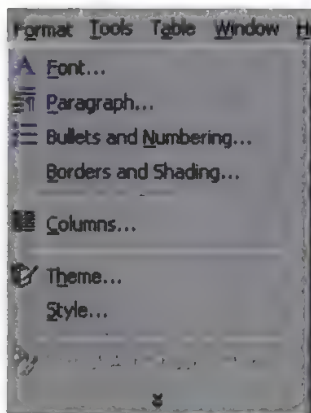
When you look at the office suites we use every day, you might be hard-pressed to think of any features that you'd like to see added. After all, suites have everything we need and then some, right? Well, you haven't seen anything yet.

Although Corel, Lotus, and Microsoft are all on slightly different schedules, over the next year all three will release major upgrades. And you'll be amazed at the new features they've managed to come up with. The ability to import and export HTML documents was nice, but new features and tools will elevate Internet and intranet publishing to a whole new level. Office suites will continue to build on some of the more compelling new features that arrived this year such as integration of speech recognition. They will work better together and integrate with other enterprise-level applications. And they will not only be easier to use, but also easier to deploy and manage.

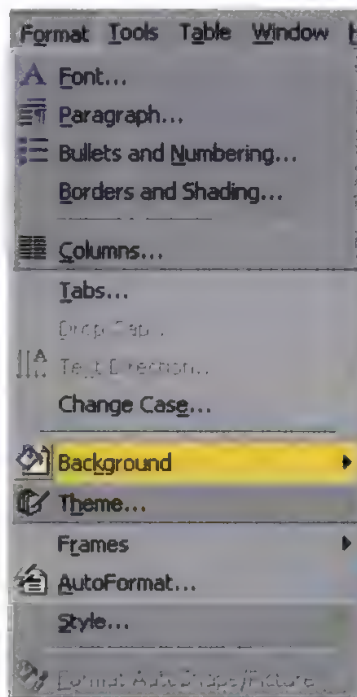
Clearly, next year will be a big year for office suites. But judging by the names of some of the current and future suites,

down-to-earth working title **WordPerfect Suite 9** for its next major release, also due out in early 1999. The last major upgrade was in May of this year, when the company integrated Dragon Systems' NaturallySpeaking. Corel also posts quarterly service packs on its Web site.

Of the big three,



▲ **PULL-DOWN** menus in Office 2000 display most-often used features first, and expand to show others. ▼ **Web Discussions** in Internet Explorer.



FrontPage extensions called Office Server Extensions (OSE) to add dynamic Web Discussions to files stored on Web servers.

In lieu of XML, the current version of SmartSuite uses extensions to HTML to maintain fidelity between HTML and binary file formats—primarily to ensure roundtrip compatibility with the Java-based Lotus eSuite WorkPlace. In the future, you can expect to see SmartSuite turn to XML to improve fidelity between HTML and regular files.

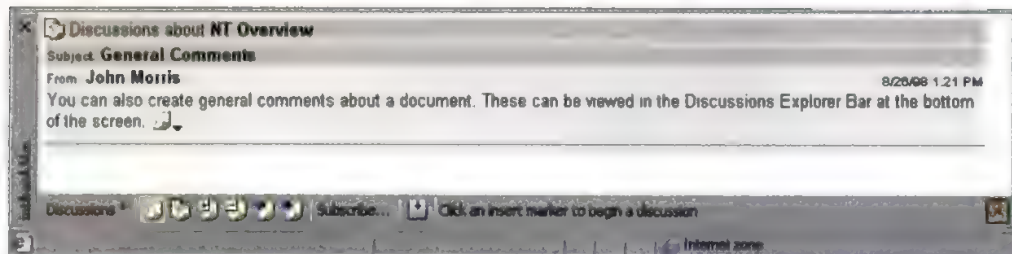
With the release of SmartSuite Millennium Edition, Lotus unveiled a Web publishing tool called FastSite. Designed primarily for intranets, FastSite lets you collect a batch of documents, select a design for them, and automatically convert them to HTML and publish them to a Web server.

Corel WordPerfect Suite 8 can import and export



HTML, and it has Java-based Barista for more complex documents. In Version 9, Corel will add XML support and make SGML (Standardized General Markup Language), a superset of XML, easier to use.

Although continuous-speech recognition is a fairly recent development, it didn't take long for Corel and Lotus to embrace it. SmartSuite Millennium Edition includes IBM ViaVoice Gold and Corel now offers a version of WordPerfect Suite 8 with NaturallySpeaking. Most recently, Lotus has released new SmartMaster templates for 1-2-3 that allow you to enter data into spreadsheets, which can be downloaded



you'd think there wasn't going to be a 1999. Lotus released **SmartSuite Millennium Edition** last June. The next major release will not appear until mid-1999, although a maintenance release is due by year's end. Meanwhile, **Microsoft Office 2000**, which is due to ship in the first quarter of next year, is already in widespread beta testing.

By contrast, Corel is still using the

ALL OPEN DOCUMENTS get their own space on the taskbar in Office 2000.

Microsoft has the most ambitious Internet plans. By using a combination of HTML for text, CSS (Cascading Style Sheets) for formatting, and XML (eXtensible Markup Language) for nonviewing attributes such as file properties, Microsoft Office 2000 gives Web documents many of the same capabilities as binary files. You can now save files directly to Web Folders within the redesigned File Save and File Open dialog boxes. And Office 2000 also uses a set of



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IBM, Gateway, or
Micron customers.*

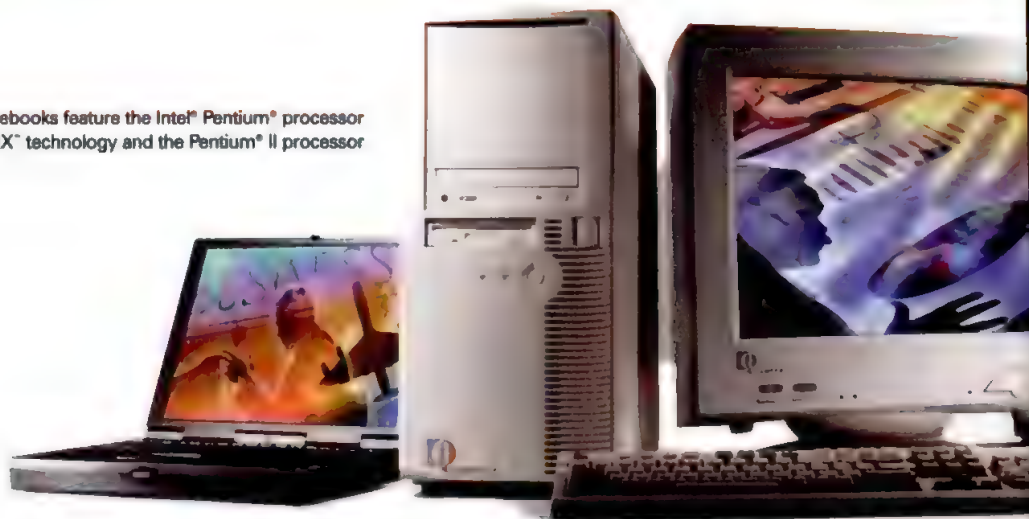
Are you?



*Results based on a Windows Magazine (Aug. '97) 'Technical Support Survey' in which Quantex received a 91% 'Buy Again Rating,' higher than that received by IBM, Micron and Gateway and on PC Magazine (July '98) 'Service and Reliability Survey' in which Quantex received the highest ratings for its customers' 'Tech Support Experience' in 4 out of 5 categories including 'tech was knowledgeable, tech tried everything to help, prompt resolution and got a run-around.' Calculations based on 25 vendors evaluated in the survey.

It's about time you

Quantex Notebooks feature the Intel® Pentium® processor with MMX™ technology and the Pentium® II processor



Today, Quantex is one of the world's largest direct marketers of computer systems, featuring the Intel® Pentium® II processor. And in the last year, Quantex has consistently placed at or near the top in surveys of customer satisfaction and tech support. As well as winning dozens of product rating awards in the most respected publications.

As more businesses and experts say good things about Quantex, you're bound to wonder, "How good can they be?" There's one way to find out.

DELL NUDGES OUT QUANTEX BY 1% FOR CUSTOMER SATISFACTION. QUANTEX CUSTOMERS VERY HAPPY. MANAGEMENT NOT!.

OK. We may not be number one in total customer satisfaction yet, but we're real close. And we can do better. That's why so many people who have bought Quantex say they'll buy Quantex again. And do. And they tell others. How else could we get this big when

WOULD YOU BUY AGAIN?	
Vendor	% who would buy the same brand
Dell	92%
Quantex	91%
IBM	89%
Micron	81%
Gateway	80%
Acer	74%
Digital	69%
Toshiba	61%
Compaq	58%
Packard Bell	51%
Windows Magazine, 8/97	

most people still don't even know our name?

QUANTEX RATED NUMBER ONE IN TECH SUPPORT. #2-#25 NEED TO TRY HARDER!.

In the most recent *PC Magazine* study, PC owners rated Quantex the leader for tech support based on their own experiences. For the technical knowledge of our people and the promptness of the resolution, no one beat Quantex. And no one came within 10 points

COMPUTER SHOPPER
1997 Direct Channel Achievement Award

PC COMPUTING
1997 Most Valuable Product Award

PC WORLD
Best Buy Award (1/98)

PC WORLD
Best Buy Award (2/98)

PC WORLD
Best Buy Award (3/98)

PC WORLD
Best Buy Award (4/98)

PC WORLD
Best Buy Award (5/98)

PC WORLD
#1 Best Buy Award (6/98)

Results based on a Windows Magazine (Aug '97) "Technical Support Survey" in which Quantex received a 91% "Buy Again Rating," higher than that received by IBM, Micron and Gateway

experienced Quantex.



Quantex Business Desktops feature the Intel® Pentium® II processor

for "tech tried everything to help." Not Dell. Not Gateway. Not Micron. Not IBM. Not Compaq.

Hey, we may not be a household name yet. So we go the extra mile. And our customers notice it.

TECH SUPPORT EXPERIENCE

Vendor	Tech was knowledgeable	Tech tried everything to help	Prompt resolution	Got a run-around
Quantex	57%	59%	49%	9%
Micron	56%	47%	43%	9%
Gateway	54%	48%	45%	10%
Dell	54%	43%	49%	10%
IBM	41%	33%	36%	15%
Compaq	37%	30%	30%	17%
Average*	40%	33%	32%	16%

"Service and Reliability Survey," PC Magazine, July 1998
* calculations based on all 25 PC vendors evaluated in the survey

QUANTEX SYSTEMS KEEP WINNING. COMPETITION AT A LOSS.

Obviously, it takes a lot more than great support to generate great customer satisfaction. And more than VERY competitive prices. It takes great computers featuring the Intel Pentium® II processor. And Quantex configures them with industry-standard "enhancements" that make Quantex systems regular winners in the "best buy" category.



**CALL TODAY
AND ORDER**

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PC WORLD
#1 Best Buy
Award (7/98)

PC WORLD
#1 Best Buy
Award (8/98)

PC WORLD
Best Buy Award
(9/98)

**WINDOWS
MAGAZINE**
WINLIST Award
(7/98)

C|NET ONLINE
Editors' Choice
Award (6/98)

PC PORTABLES
Best Buy Award
(3/98)

PC COMPUTING
4-star "Torture Test"
Survivor (4/98)

PC COMPUTING
4-star Rating
(9/98)

*Results based on PC Magazine (July '98) "Service and Reliability Survey" in which Quantex received the highest ratings for its customers' "Tech Support Experience" in 4 out of 5 categories including 'tech was knowledgeable, tech tried everything to help, prompt resolution and got a run-around.' Calculations based on 25 vendors evaluated in the survey



Systems with better

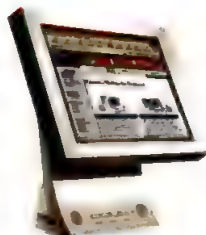


BETTER MANAGEABILITY MEANS BETTER PRODUCTIVITY FOR YOUR BUSINESS.

Quantex Business Desktops bring enterprise management technology, traditionally implemented by large corporations, to businesses of all sizes—including yours. Built according to industry-standard Initiatives such as Wired for Management, DMI 2.0, PC '98, LDCM and ACPI, these desktops are designed to lower your total cost of ownership. They also incorporate capabilities for improved asset management, remote wake-up of systems over the LAN and remote configurations and diagnostics. Plus, our innovative Q Sentry technology assures unsurpassed confidence and security by constantly monitoring the health of Quantex PCs. If you want to do something more productive, install Quantex Business Desktops. **Starting at just \$1049**

LCD FLAT PANEL DISPLAY

Looking to provide your business with a better view? Quantex gives it to you right between the eyes with this state-of-art 15" LCD monitor with on-screen controls.



Engineered with the category's most advanced technologies, this active matrix TFT flat panel produces clear, crisp pictures with bright vivid colors. And a 15.0" viewable area that outperforms many large screen monitors. Including landscape and portrait modes. All this while saving approximately 75% of the desk space and up to 70% of the power used by traditional CRT's.

Quantex Notebooks: How do you define performance?

THE "H" SERIES:
Much more than you
thought you could afford.



Having taken three consecutive PC World #1 Best Buy Awards (06/98-08/98), the Quantex Notebook is a proven price/performance winner—including core mobile technologies for one great price. For the perfect combination of features and functionality for any type of business environment, you've got to check it out. **Starting at just \$1999**

THE "T" SERIES:
Think bigger. Carry smaller.

Get the full force of today's state-of-the-art mobile technology in a lean, 1.45 inch thick, 6.4 pound notebook. Look at the Quantex T-1411 and start packing more by carrying less. **Starting at just \$2999**

THE "I" SERIES:
It just doesn't get any better.

For extreme mobile computing power and performance, the Quantex I-1411 is as good as it gets. Boasting a big 14.1," 1024x768 display, fast mobile Pentium® II processor 300MHz, AGP graphics technology and advanced communications it doesn't just replace your desktop. It humbles it. **Starting at just \$3199**

CALL 800-346-6572 TO ORDER OR

performance built in.

BUSINESS NOTEBOOKS

Quantex H-1330 \$2199

Business lease: \$77/Mo.

- Pentium® II processor 266MHz
- Intel Mobile Module (I.M.M.) Architecture
- 13.3" XGA Active Matrix Display
- 32MB SDRAM
- 512KB Secondary Cache
- 4GB Ultra ATA HD / 3.5" 1.44MB Modular Floppy Drive
- PCMCIA K56flex protocol Fax/Modem*
- 24X Modular CD-ROM Drive
- PCI Bus with 128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows 98
- Corel Office Suite 8
- Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

H-1330 w/Pentium® II processor 233MHz.....\$1899

OPTIONS: Mini-Docking Station \$149 • 2nd Lithium Ion Battery \$129 • PCMCIA NIC \$129 • Deluxe Carrying case \$99

Quantex H-1331 \$2499

Business lease: \$88/Mo.

- Pentium® II processor 266MHz
- Intel Mobile Module (I.M.M.) Architecture
- 13.3" XGA Active Matrix Display
- 64MB SDRAM
- 512KB Secondary Cache
- 4GB Ultra ATA HD / 3.5" 1.44MB Modular Floppy Drive
- PCMCIA K56flex protocol Fax/Modem*
- 24X Modular CD-ROM Drive
- PCI Bus with 128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- 2nd Lithium Ion Battery
- Mini-Docking Station
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows 98
- Microsoft Office® '97 SBE Ver 2
- Carrying Case
- 3-year limited warranty on CPU and Main Memory

H-1331w/Pentium® II processor 300MHz.....\$2749

Quantex T-1411 \$3199

Business lease: \$104/Mo.

- Pentium® II processor 300MHz
- Intel Mobile Module (I.M.M.) Architecture
- 14.1" XGA Active Matrix Display
- 96MB SDRAM
- 512KB Secondary Cache
- 6GB Ultra ATA HD / 3.5" 1.44MB Modular Floppy Drive
- 56K V90 Fax/Modem*
- 2X DVD-ROM Drive
- PCI Bus with 128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- 2nd Lithium Ion Battery
- Mini-Docking Station
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows 98
- Microsoft Office® '97 SBE Ver 2
- Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

T-1411 w/Pentium® II processor 266MHz.....\$2999

Quantex I-1411 \$3399

Business lease: \$111/Mo.

- Pentium® II Processor 300MHz
- Intel Mobile Module (I.M.M.) Architecture
- 14.1" XGA Active Matrix Display
- 128MB SDRAM
- 512KB Secondary Cache
- 6GB Ultra ATA HD / 3.5" 1.44MB Modular Floppy Drive
- 56K V90 Fax/Modem*
- 2X DVD-ROM Drive
- ATI 3D AGP Graphics Accelerator w/8MB
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- 2nd Lithium Ion Battery
- Mini-Docking Station
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows 98
- Microsoft Office® '97 SBE Ver 2
- Carrying Case
- 3-year limited warranty on CPU and Main Memory
- Upgrade to 8GB Ultra ATA Hard Drive for \$149

I-1411 w/Pentium® II processor 266MHz.....\$3199

BUSINESS DESKTOPS

QP6/300 SB-1 \$1099

Business lease: \$39/Mo.

- Pentium® II Processor 300MHz
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- 32MB SDRAM Memory / 512KB Secondary Cache
- 4.3GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 64-bit 3D PCI Graphics Card with 4MB SDRAM
- 15" Digital Monitor (13.8" viewable)
- Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- QSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Upgrade to Windows NT Workstation 4.0 for \$99

QP6/266 SB-1w/ Pentium® II Processor.....\$1049

MS OFFICE '97 SBE VER 2 : Word 97 • Excel 97 • Publisher 98 • Outlook 98 • Direct Mail Manager
• Small Business Financial Manager 98 • Expedio Streets 98 • IE 4.0

QP6/350 SB-2 \$1499

Business lease: \$53/Mo.

- Pentium® II Processor 350MHz
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 6.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740™ 3D AGP Graphics with 8MB SDRAM
- 17" Digital Monitor w/ OSD (15.8" viewable)
- Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
- Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98
- Microsoft Office® '97 SBE Ver 2
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- QSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Upgrade to Windows NT Workstation 4.0 for \$99
- Add 56K V.90 Fax/Modem* for \$39

QP6/333 SB-2w/ Pentium® II Processor.....\$1399

QP6/400 SB-3 \$1849

Business lease: \$65/Mo.

- Pentium® II Processor 400MHz
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740™ 3D AGP Graphics with 8MB SDRAM
- 17" Digital Monitor w/OSD & NEC ChromaClear CRT (16.0" viewable, 25 dp, 1600x1200 max resolution)
- Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- Microsoft Office® '97 SBE Ver 2
- Upgrade to MS Office® '97 Professional for \$199
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- QSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Add 56K V.90 Fax/Modem* for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$549

QP6/250 SB-3w/ Pentium® II Processor.....\$1649

QP6/450 SB-4 \$2299

Business lease: \$81/Mo.

- Pentium® II Processor 450MHz
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- #9 Revolution IV 128-bit 3D AGP Graphics with 32MB
- 19" Monitor w/ OSD (18.1" viewable), 1600x1200, 26dp
- Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- Microsoft Office® '97 SBE Ver 2
- Upgrade to MS Office® '97 Professional for \$199
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- QSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Add 56K V.90 Fax/Modem* for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 SB-4w/ Pentium® II Processor.....\$2099

BUSINESS SERVERS

QX5000 Server \$2499

Business lease: \$88/Mo.

- Pentium® II Processor 450MHz (Dual-Processor Upgradable)
- 64MB 100MHz ECC SDRAM (1GB Max.) / 512KB L2 ECC Cache
- 32X Max EIDE CD-ROM Drive/3.5" 1.44MB Floppy Drive
- 4GB Ultra-Wide SCSI-3 Hot-Swappable Hard Drive
- Dual Channel Ultra-Wide & Narrow SCSI-3 Controller
- Intel EtherExpress Pro™ 100B Fast Ethernet w/RJ-45
- Server Tower Case w/ 5 Hot-Swap Bays
- 1y0 - Ready to RAID capable
- Emergency Management Port
- 3-year limited warranty with 1-year On-Site Service**
- Intel LANDesk Server Manager V2.8

QX5000 Server \$3799

Business lease: \$124/Mo.

- Pentium® II Processor 450MHz (Dual-Processor Upgradable)
- 128MB 100MHz ECC SDRAM Memory
- 9.1GB Ultra-Wide SCSI-3 Hot-Swappable Hard Drive
- MS Windows NT Server 4.0 w/10 Client License

QX4000 Small Business Server \$1999

Business lease: \$130/Mo.

- Pentium® II Processor 400MHz (Dual-Processor Upgradable)
- 512KB L2 ECC Cache
- 128MB 100MHz ECC SDRAM Memory (1GB Max.)
- 3.5" 1.44MB Floppy Drive
- 4GB Ultra-Wide SCSI-3 Hard Drive (7200 rpm)
- 15" Digital Monitor (13.8" viewable)
- Dual Channel Ultra-Wide & Narrow SCSI-3 Controller
- 32X Max EIDE CD-ROM Drive
- K56flex protocol Fax/Modem*
- Intel EtherExpress Pro™ 100B Fast Ethernet w/RJ-45
- Mid Tower Server Case
- 104-Key Keyboard with MS Mouse
- Microsoft® BackOffice® Small Business Server Suite
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- Intel LANDesk Server Manager V2.8
- Call for Special Server Support Options
- Call for additional processor configurations



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VALUE MULTIMEDIA

QP6/300M-1x \$1199

Business lease: \$42/Mo.

- Pentium® II Processor 300MHz
- 64MB SDRAM Memory / 512KB Secondary Cache
- 10 2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 64-Bit 3D PCI Graphics Accelerator with 4MB
- 15" Digital Monitor (13.8" viewable)
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**

QP6/350 M-1x(with Pentium II processor).....\$1349

SOFTWARE: Corel Office Suite 9 • MS Money '97 • Compton's Interactive Encyclopedia • Body Works 6.0 • Amazon Trail II
American Heritage Talking Dictionary • Internet the City • Compton's Reference Collection • Dr. Solomons Find Virus • MS Internet Explorer 4.0

QP6/333M-2x \$1499

Business lease: \$53/Mo.

- Pentium® II Processor 333MHz
- 64MB SDRAM Memory / 512KB Secondary Cache
- 8 4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Toshiba IMPACT2 3D Media Accelerator w/8MB SDRAM
- 17" Digital Monitor w/OSD (15.8" viewable)
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**

QP6/350 M-2x(with Pentium II processor).....\$1599

QP6/350 M-3x \$1699

Business lease: \$60/Mo.

- Pentium® II Processor 350MHz
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10 2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Toshiba IMPACT2 3D Media Accelerator w/8MB SDRAM
- 17" Digital Monitor w/OSD (15.8" viewable)
- Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle

QP6/400 M-3x(with Pentium II processor).....\$1899

QP6/400 M-4x \$1999

Business lease: \$70/Mo.

- Pentium® II Processor 400MHz
- 64MB PC100 SDRAM Memory
- 512KB Secondary Cache
- 10 2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle
- Add Altec Lansing ACS-251 Subwoofer for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/450 M-4x(with Pentium II processor).....\$2199

POWER MULTIMEDIA

QP6/400 SM-1x \$1799

Business lease: \$63/Mo.

- Pentium® II Processor 400MHz
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10 2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 17" Digital Monitor w/OSD (15.8" viewable)
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-45 1 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE Ver 2
- 3-year limited warranty with 1-year On-Site Service**

QP6/350 SM-1x(with Pentium II processor).....\$1599

SOFTWARE: MS Office '97 Small Business Edition Ver 2 • MS Money '97 • Office Mate • Day Planner Pro • Power Business Plans • Form Designer Pro
Project Manager Pro • Labels Unlimited • Compton's Reference Collection • Dr. Solomons Find Virus • MS Internet Explorer 4.0

QP6/400 SM-2x \$1999

Business lease: \$70/Mo.

- Pentium® II Processor 400MHz
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 12 9GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 17" Digital Monitor w/ OSD & NEC ChromaClear CRT (16.0" viewable, 25 dp, 1600x1200 max. resolution)
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-45 1 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE Ver 2
- Upgrade to 15.0" LCD Flat-Panel Display for \$549

QP6/450 SM-2x(with Pentium II processor).....\$2199

QP6/450 SM-3x \$2399

Business lease: \$84/Mo.

- Pentium® II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 12 9GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 9 Revolution IV 128-bit 3D AGP Graphics with 32MB
- 17" Digital Monitor w/ OSD & NEC ChromaClear CRT (16.0" viewable, 25 dp, 1600x1200 max. resolution)
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-45 1 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE Ver 2
- Upgrade to 15.0" LCD Flat-Panel Display for \$549

QP6/400 SM-3x(with Pentium II processor).....\$2199

QP6/450 SM-4x \$2699

Business lease: \$95/Mo.

- Pentium® II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 16 8GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-490 Dolby Surround Sound Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE Ver 2
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 SM-4x(with Pentium II processor).....\$2499

SUPER MULTIMEDIA

QP6/400 M-4x SE \$2199

Business lease: \$77/Mo.

- Pentium® II Processor 400MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 12 9GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Internal 100MB Zip Drive with one cartridge
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 3rd-Generation DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**
- Add Altec Lansing ACS-251 Subwoofer for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/450 M-4x SE(with Pentium II processor).....\$2399

QP6/450 SM-4x SE \$2999

Business lease: \$105/Mo.

- Pentium® II Processor 450MHz
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 16 8GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 9 Revolution IV 128-bit 3D AGP Graphics with 32MB
- 21" Monitor w/OSD (20.0" viewable), 1600x1200, 26dp
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altec-Lansing ACS-490 Dolby Surround Sound Speakers & subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE Ver 2
- 3-year limited warranty with 1-year On-Site Service**

QP6/400 SM-4x SE(with Pentium II processor).....\$2799

ULTIMATE GAMING PCS

QP6/400 GX-1 \$1999

Business lease: \$70/Mo.

- Pentium® II Processor 400MHz
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10 2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- Intel740 3D AGP Graphics with 8MB SDRAM
- 17" Digital Monitor w/OSD (15.8" viewable)
- 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- Aureal "A3D" 3D Positional PCI Sound
- 3Dfx Voodoo2 based 3D Game Accelerator w/12MB
- MS SideWinder 3D Pro Joystick
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from www.lotus.com/smartsuiteupdates. No other suite offers this level of speech integration yet. In 1999, expect to see Lotus update the ViaVoice speech recognition engine and enable dictation across more applications.

While Corel has not discussed plans for NaturallySpeaking, Microsoft has adopted a wait-and-see approach. The company has invested in Lernout & Hauspie's Voice Xpress, which provides tight integration with Microsoft Word, so it's clear that speech recognition will eventually find its way into Office. The stand-alone versions of NaturallySpeaking and ViaVoice also integrate with Word. For more on the current state of speech recognition technology, see "Finding Its Voice" in this issue.

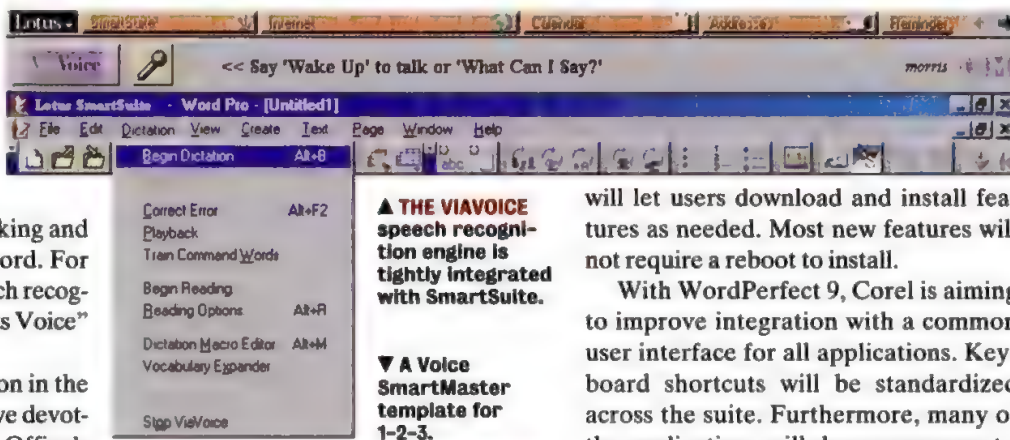
In a nod to Microsoft's position in the market, both Corel and Lotus have devoted a lot of effort to supporting Office's

emphasis on integration with document management systems such as PC DOCs and Novell GroupWise.

Ease of use is hardly a new concept for office suites. Indeed, one of the primary advantages of an integrated suite of applications is that it is easier to use. But Corel, Lotus, and Microsoft are starting to think about ease of use in broader terms.

Office settings and transfers them to a new system. Just about everyone will be pleased to hear that Office 2000 keeps all the same file formats as its predecessor, except for Access. Finally, Office 2000 is a single, worldwide executable with 36 different language packs.

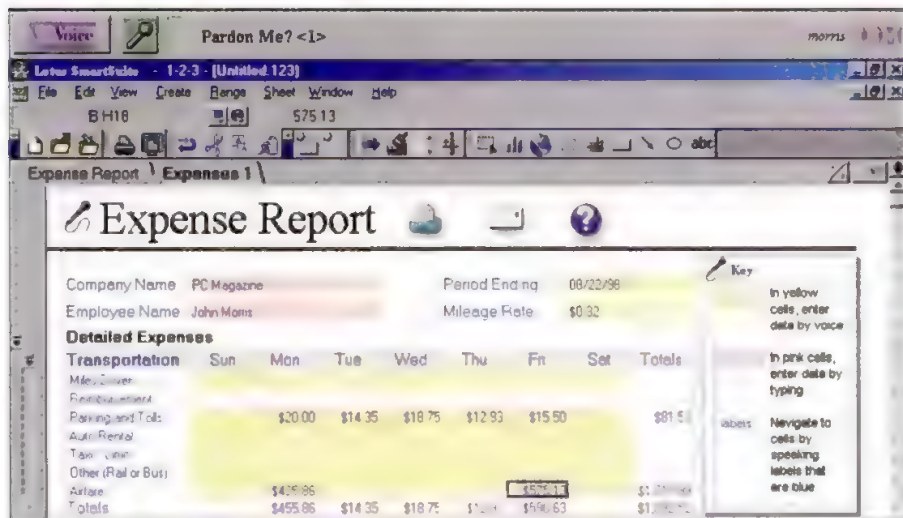
Corel is also reworking its installation routine. A new Install As You Go option



will let users download and install features as needed. Most new features will not require a reboot to install.

With WordPerfect 9, Corel is aiming to improve integration with a common user interface for all applications. Keyboard shortcuts will be standardized across the suite. Furthermore, many of the applications will share components, including the drawing, charting, and print engines.

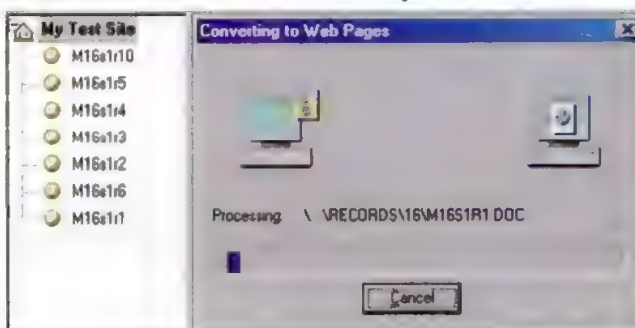
All these are just the start. Other things we especially like in Office 2000 include the new and improved Office Assistants (including a highly animated dog named Rocky), smart pull-down menus that highlight the most often-used features, and a Collect and Paste clipboard that makes it easier to gather information from multiple places. The Real-Time Preview feature in WordPerfect 9 should be a big hit as well. It shows you exactly how a change will affect your entire document by temporarily reformatting it before you commit. In fact, there are so many cool new features it



formats and features. For instance, Quattro Pro will support PivotTables and Excel's borders and fills. In addition to getting along better with one another, office suites are also improving relations with other types of applications. Access 2000 can connect directly to SQL servers, and new Office Web Components transform Office 2000 into a front end for querying and analyzing corporate data.

SmartSuite and the next version of WordPerfect Suite will provide connectors for ERP (Enterprise Resource Planning) applications such as PeopleSoft and SAP. SmartSuite can also read and write Lotus Notes NSF format. Corel places a lot of

Microsoft starts with a new Windows Installer technology, which checks for previous versions of Office 2000 and either removes all settings and files or automatically transfers them. You can run Office 2000 from a terminal server, network server, desktop, or Install on Demand. If you use more than one system, you'll really appreciate the new Office Profile Wizard that packs up all customized



▲ LOTUS'S FastSite Intranet batch publishing tool.

would be impossible to cover them all here. But take our word for it, you'll find a lot to like.—John Morris

Internet Software Preview

An Internet year isn't what it used to be. That go-go Silicon Valley time in the mid-1990s, when the level of innovation and development reached breakneck speeds and products revved up every three to six months is over—at least for the crucial tools we use every day. But that's not altogether bad. Stability and ease of use tended to fall by the wayside in the push to get products out before the competition. Users now demand productivity tools—browsers, e-mail clients, and Web authoring tools—that don't crash every 10 minutes and don't require reeducation with each new version.

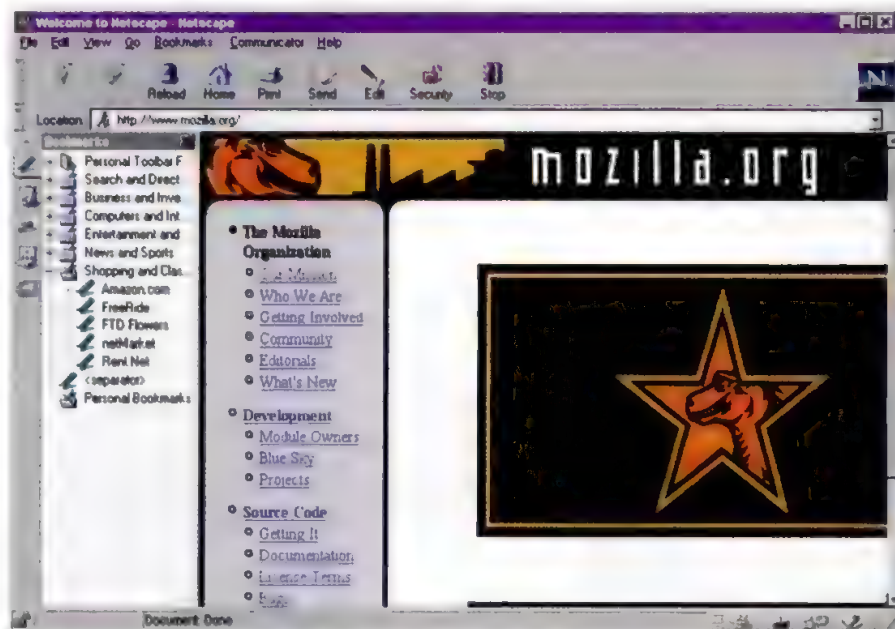
And the companies that produce these products seem to be listening. New versions once appeared every few months, but we will have to wait about 18 months for new browsers from Microsoft and Netscape. In many ways, these new browsers will be evolutionary upgrades, but they may ultimately change the way we work and experience the Web.

The most important changes will be in performance and in the types of Web applications that can be built on wider standards support. **Internet Explorer 5.0** will support the Cascading Style Sheets (CSS) 2.0 recommendation, and Netscape plans largely to support it as well in **Navigator 5.0**. With CSS2, for instance, developers can

Model (DOM) that IE supports, meaning that cross-browser compatibility issues should begin to reach a measure of détente.

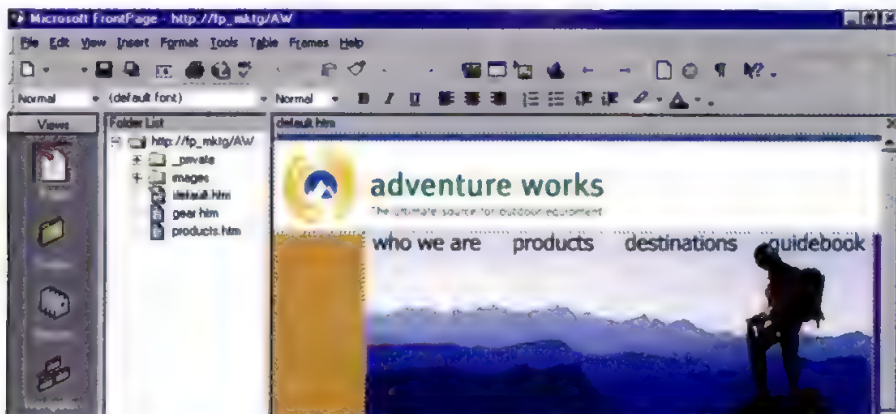
This may very well unlock the potential of Dynamic HTML, as both browsers will

Further development with eXtensible Markup Language (XML) is another trend that will have a significant impact on the browsing experience. XML is a language for structuring data, and both Version 5.0 browsers will include an XML parser to process XML documents. (IE4 had a parser; Netscape acquired a parser through its Mozilla open source code program.) This will let developers write XML applications



▲ A GLIMPSE of the browser bars in Navigator 5.0 that are based on Netscape's RDF (Resource Description Framework) format.

▼ THE FRONTPAGE explorer and editor will be brought together in FrontPage 2000.



write code that tells the browser the details of a table layout so the browser can render it progressively, minimizing the wait.

Netscape is overhauling its layout engine with the aim of building a browser that is faster and smaller. Navigator will support elements of the Document Object

support it. DHTML (based on DOM) lets developers create Web applications that run on the client end, alleviating the need for continual trips to the server for more data. It not only makes the Web experience faster but also will let you do more on a Web page, as though it were an application.

that can run in the browser. Its most immediate use will be in Navigator's Resource Description Framework (RDF)—an offshoot of XML that organizes related information for easier reference.

Both Microsoft and Netscape share similar goals, but each will add some new wrinkles. Netscape's strategy is to link the browser to its Netscape portal, giving you a consistent, customized working environment no matter where you connect. Your bookmarks, personal address book, and such will sit on the server, and you'll access them via Netcenter whether you're in your office, at home, or at a cybercafé.

Some of this Netcenter integration is already evident in **Navigator 4.5 with Smart Browsing**, a concept that encompasses two distinct features: Internet Keywords and What's Related. With Internet Keywords, you can type a topic into the browser's address bar, and, by steering you through Netcenter's index, the browser will take you to the site it thinks you intended. What's Related is a drop-down menu to the right of the address bar that lists sites relat-

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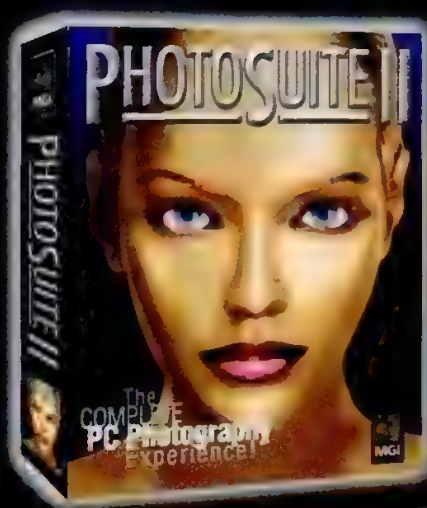
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SOFTWARE

Sneak Preview

ed to the one you're currently viewing.

Microsoft has no plans for a competitor to Smart Browsing, but it's working on better ways to find information on the Web. Microsoft's strategy seems to be a broadening of the target market for IE to include those users who rely on browsers as productivity tools.

Around the time you read this, Microsoft expects to have a beta version of IE5. Netscape will be releasing a beta version of Navigator 5.0 before the end of the year. But neither company will reveal its planned shipping date, although the first quarter of 1999 is probably a safe bet for both of them.

Netscape's Netcenter strategy will also have an impact on the messaging arena. In

Netscape's notion of a networked user.

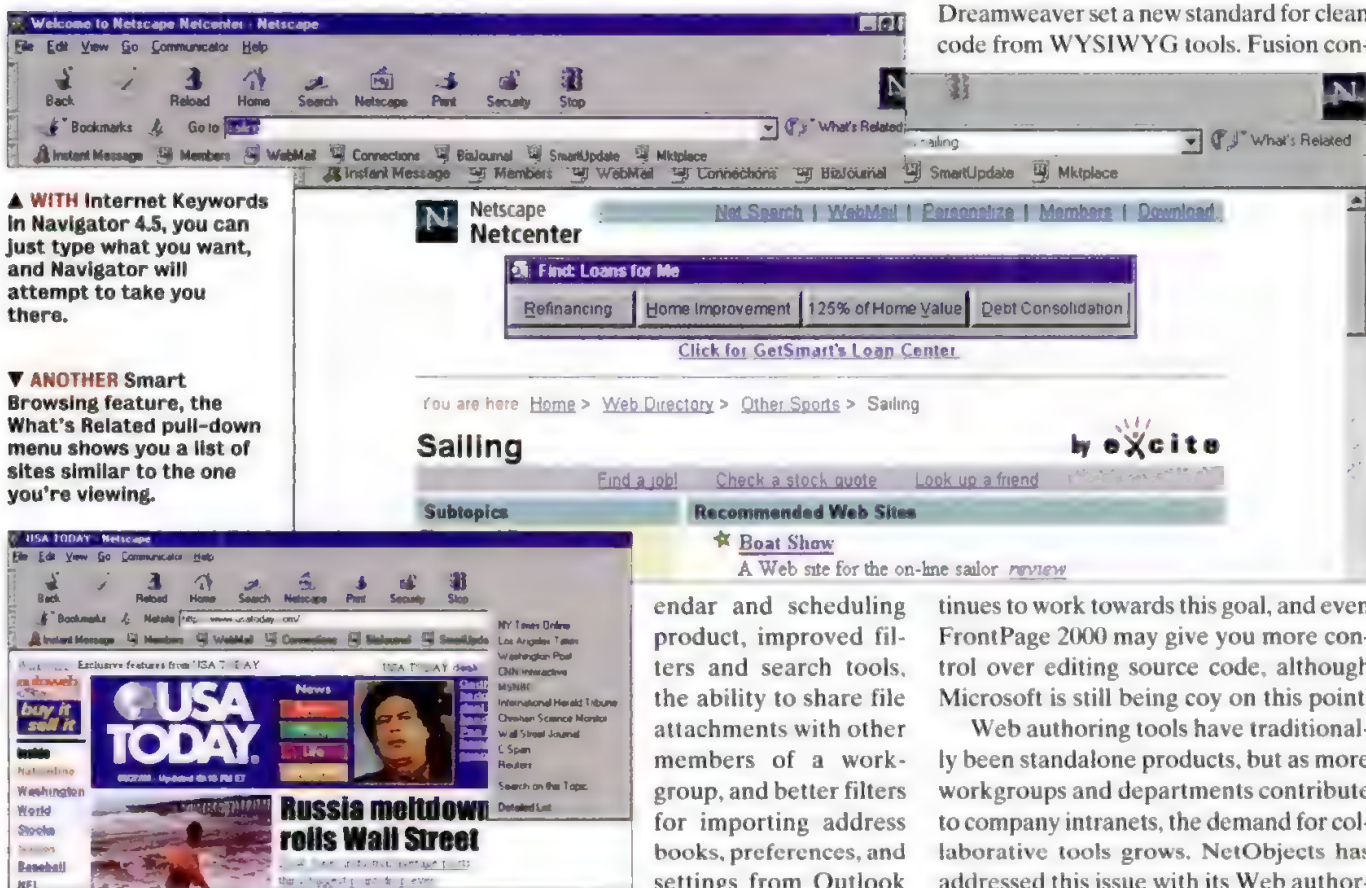
Although Microsoft appears to be steering IE into the corporate space, **Outlook Express** (OE) remains strictly a consumer product. Goals for the next version include better support for multiple users on a single machine, enhanced spam filtering, and the addition of a community aspect. We can only speculate that this entails a link between Microsoft's new MSN Messenger instant messaging client and OE. Netscape already bundles AOL Instant Messenger with its browser suite.

Qualcomm recently released an update of its popular **Eudora Pro Email** client. The next version is due sometime early next year. It will include tighter integration with the Eudora Planner cal-

seeking to address all these concerns with their forthcoming releases.

Both **Macromedia Dreamweaver** and **NetObjects Fusion** are very much in step as they move forward. Both have targeted the ability to create dynamic Web sites within their graphical environments. Macromedia has already partnered Dreamweaver with Allaire's Cold Fusion and is looking for other partners. Both Macromedia and NetObjects are also seeking to partner with third-party e-commerce tool vendors, such as iCat. Microsoft has said little about its plans in these areas, but when you consider that **FrontPage 2000** is part of the Microsoft Office family (which includes Access), this seems a likely direction.

When it made its debut a year ago, Dreamweaver set a new standard for clean code from WYSIWYG tools. Fusion con-



▲ **WITH Internet Keywords** in Navigator 4.5, you can just type what you want, and Navigator will attempt to take you there.

▼ **ANOTHER Smart Browsing** feature, the What's Related pull-down menu shows you a list of sites similar to the one you're viewing.

addition to being able to store your **Netscape Messenger** address book on the server, Netscape is also linking Messenger and WebMail, its Web-based e-mail client. Using IMAP, you can check your e-mail on the road from any PC with a browser. And when you get back to the office, you can view the same, up-to-date mail file from your desktop PC using Messenger. This will definitely give a kick-start to

and Messenger.

Web designers are looking for a lot from today's authoring tools. They want programs that can create dynamic data-driven Web sites, build e-commerce solutions, and in the case of WYSIWYG tools, produce clean, editable HTML code. They also want tools that lend themselves to a more collaborative authoring environment. The major authoring tools are

continues to work towards this goal, and even FrontPage 2000 may give you more control over editing source code, although Microsoft is still being coy on this point.

Web authoring tools have traditionally been standalone products, but as more workgroups and departments contribute to company intranets, the demand for collaborative tools grows. NetObjects has addressed this issue with its Web authoring server, NetObjects authoring Server Suite 3.0. FrontPage will team up with Office 2000 to offer similar functionality.

FrontPage 2000 is expected to ship with Office 2000, sometime in the first quarter of 1999. NetObjects Fusion will appear around the same time. Macromedia says the next version of Dreamweaver should ship by the end of the year.—David Lidsky and Doug Beizer

Messaging and Groupware

In spite of the trend toward Internet-standard messaging, the market continues to be dominated by Lotus Domino, Microsoft Exchange Server, and Novell's GroupWise—all products traditionally regarded as proprietary solutions. But these three leaders have done a very good job of embracing standards such as

page, will provide a quick look at e-mail, calendar, and any other summary information that the user or the organization wants to display at start-up. In Release 5.0, Lotus once again tries its hand at building a browser—this time with support for HTML4, JavaScript, Java, and Internet graphics formats. The Notes client will

also support IMAP4, LDAP, and NNTP, so it can be used on its own.

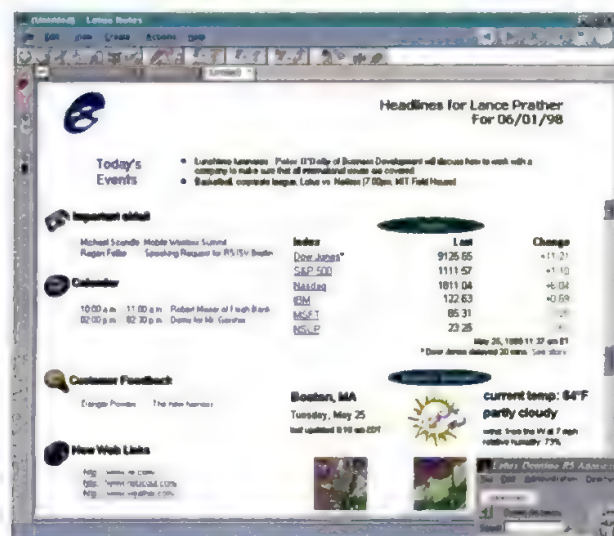
Over the next 12 to 18 months, Microsoft is taking a few little steps and eventually one giant step with the introduction of a new version of Exchange. High on Microsoft's agenda is making Exchange coexist better with Domino servers while also providing tools to move

Notes users over to Exchange. Among the improvements in the recently released Service Pack 1 for Exchange Server 5.5 is a Lotus Notes mailbox migration tool. Five new migration tools based on products acquired by Microsoft from the Mesa Group should ship by the end of the year.

Microsoft is scheduled to release the next major upgrade to Exchange, code-named **Platinum**, three to four months after it releases Windows NT 5.0 in mid-1999. Platinum will use NT 5.0's Active Directory for its directory services and will be tightly integrated with the new operating system's administration tools, allowing role-based administration and customization via scripting.

Novell hasn't announced a full-point release update for **GroupWise 5.2** yet, but a significant interim update, **Version 5.5**, should be shipping by the time you read this. A key focus of the new version will be enhancing the document management features. GroupWise 5.5 will also be much smarter about talking to the outside world. The software will know when to route links to documents and when to

route the actual document, depending on whether the recipient has access rights to the GroupWise document library. Also, the groupware package will be able to identify whether a user outside the organization is also



IMAP4, POP3, and SMTP without sacrificing the robustness and maturity you'd expect from a proprietary package. Over the next year, we expect to see major new versions from Lotus and Microsoft, as well as an important update to GroupWise.

Due around the end of this year, **Lotus Domino Release 5.0** appears to be as significant an upgrade as Release 4.0. Lotus will continue to cast the server in multiple roles including proprietary mail server, Internet mail server, and application server for both Notes and the Web.

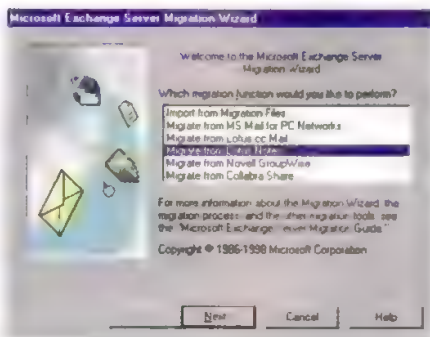
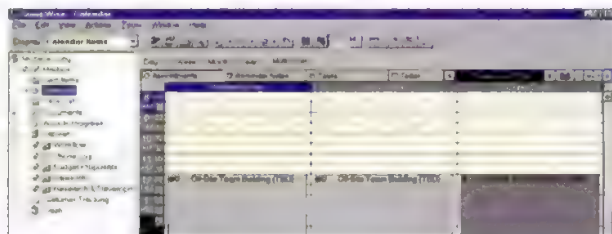
As an enterprise messaging server, the new version should be able to handle two to four times as many users per server, according to Lotus. An improved directory with support for LDAP Version 3.0 should accommodate more than a million entries with significantly faster lookups.

The Notes Release 5.0 client will barely resemble the client of today. Gone is the familiar Workspace page, which has been replaced by portfolio tabs on the side of the screen. A new Headlines page, similar to Microsoft Outlook's Outlook Today



IN RELEASE 5, the Notes client gets a face-lift. Domino includes a new administrative tool with a simpler interface.

► **THE CALENDAR view in GroupWise 5.5 client.** ▼ **The Exchange 5.5 service pack has a Notes migration tool.**



a GroupWise user, and if so, will provide features such as rich messaging, free/busy time lookup, and message retraction. Finally, Novell will include its Web publishing and e-mail tools.

Next year won't bring us the open, standards-based workgroup computing we all dream about. But it will certainly bring us a step closer, and at the same time, deliver more powerful collaboration tools.—Ben Gottesman



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Home and Entertainment Software

Though most of us haven't finished our holiday shopping yet, the makers of games, educational titles, and other home software are busy trying to come up with next year's big hit. From ultrarealistic 3-D and Teletubbies games to personal productivity tools, you and your kids will find a lot to like in next year's consumer titles.

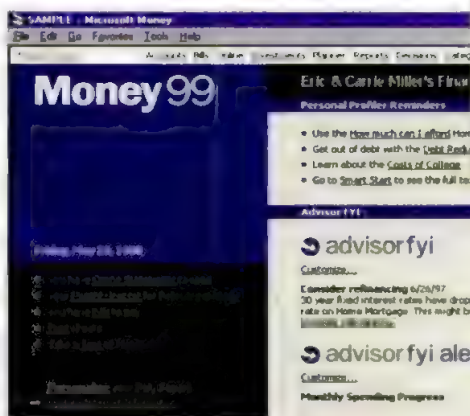
The list of manufacturers planning to

titles. Later this year, Nickelodeon's **Rugrats** will appear on CD-ROM in both an adventure game and an activity center. Similarly, Knowledge Adventure has

that let you actually do something with the PC. Home-design and genealogy programs are two prominent examples. Expect at least two upgrades per year from all the major players in the genealogy market. Sierra is set to release one of the most exciting programs we've seen in the home market for some time: **Fashion Trip** will let you shop for and purchase name-brand apparel without leaving your desk.

Microsoft has already released the next version of its personal finance program, **Money 99**, and Intuit should be shipping **Quicken 99** by the time you read this. Seeking to retain its edge in the market, Intuit has added a **Quicken Home Page** that, like the **Financial Home Page** that made a debut in **Money 98**, provides a quick snapshot of your finances. You can now download all of your account activity, stock prices, news, and alerts in a single step, and the **QuickEntry** applet lets you enter transactions without launching the program. Microsoft is hoping to make some inroads with **Money 99** and the **Money 99 Financial Suite**. Key new features include a **Personal Profile** interview that tailors the program to your financial situation and a detailed **Lifetime Planner**. By the end of the year, Microsoft reportedly will also release its first tax preparation package, **TaxSaver**, a competitor to Intuit's **TurboTax**.

Finally, reference could become one of the driving forces behind DVD-ROM in 1999. **Compton's Interactive Encyclopedia**, **Microsoft Encarta** and **Mindscape's National Geographic** should find their way onto DVD in 1999.
—Jennifer Triverio PC



▲ ABOVE RIGHT, Intuit's **Quicken 99** includes a new financial home page. In **Money 99**, Microsoft has made the home page more customizable.

release 3-D acceleration-based games from late 1998 through mid-1999 seems endless. Among the new titles will be Activision's **Heretic II**, Blizzard Entertainment's **Diablo II**, 3D Realm's **Duke Nukem Forever**, and Ion Storm's **Diakrana**.

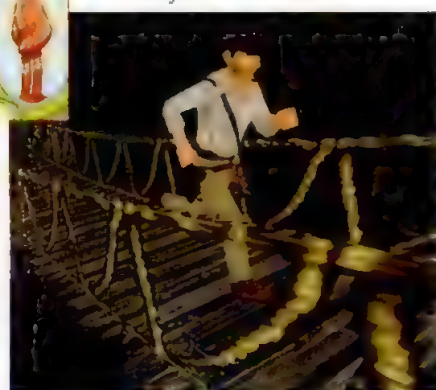
If you plan to get into the game, however, you'll need some top-notch hardware—especially a 3-D graphics board. Accelerators such as the 3Dfx's **Voodoo Banshee**, which supports both 2-D and 3-D applications, should become more prevalent in 1999. Force-feedback peripherals are also in vogue. Led by Microsoft, which currently has two force-feedback products on the market, gaming manufacturers such as Sierra and 3DO will be releasing force-feedback-compatible games or game update patches.

Licensing TV characters is becoming all the rage as the makers of children's software are using some popular characters to deliver engaging

landed **Sabrina the Teenage Witch**, **Captain Kangaroo**, and the **Teletubbies**.

Since the release of Knowledge Adventure's **JumpStart First Grade** three years ago, the **JumpStart** and **Fisher-Price** titles have been best-sellers, and the industry has taken note and is making a push into the software-for-the-teething-set market. Set to debut this fall and winter are Knowledge Adventure's **Teletubbies**, Creative Wonders' **Elmo's Reading Preschool & Kindergarten**, and Dr. Seuss' **Kindergarten** from Broderbund Software.

Meanwhile, home- and hobby-oriented software is returning to its utilitarian roots. The genre of coffee-table books on CD-ROM has all but disappeared, replaced by programs



CLOCKWISE FROM TOP: Creative Wonders' **Elmo** helps toddlers learn to read, Lucas Arts puts **Indiana Jones** back in action, and Sierra has the killer app for the clothes horse.

Desktop Scanners

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CCD scanners deliver outstanding image quality, but their optical systems make them bulky and complex.

By Daniel Grotta and
Sally Wiener Grotta

This wasn't just any year in the PC scanner business. Prices for high-quality color flatbed scanners fell dramatically (to below \$100 in some cases). More important, CIS (contact image sensor), a new technology that has resulted in significantly smaller and lighter scanners, has debuted to compete with traditional CCD (charge-coupled device) engines.

The explosion of inexpensive PCs for home users, easy-to-use image-editing software, and the pervasive use of color photos in both professional and family documents and Web pages have made color flatbed scanners almost ubiquitous desktop peripherals. Most of the 25 scanners we tested can be easily installed in minutes, and their point-and-

scan interfaces are relatively simple to operate. As for price, the most inexpensive scanner in this feature a year ago was \$250; this year, 15 of the 25 come in at \$200 or less, and we have 5 entries priced at \$100 or below.

A CHALLENGE TO CCD?

The other shift is technological. Until recently, the heart of all color flatbed scanners (as well as camcorders and digital cameras) was a tiny photosensitive semiconductor chip, called a CCD. Scanning using a CCD requires an elaborate system consisting of mirrors and a lens to focus the image on the CCD. This complexity is somewhat costly, and the delicate optics can become misaligned, adversely affecting scan quality (see the diagram "CCD vs. CIS").

what's next

25 COLOR FLATBED SCANNERS.



Enter the contact image sensor, which replaces the CCD scan head and lenses with a row of 300 or 600 sensors as wide as the scanbed and positioned only a millimeter or two below the original. CIS eliminates the CCD housing, mirror and lens, and the fluorescent or cold cathode tube. What's more, the sensors' proximity to the original means that flatbed scanners can be made as thin as or thinner than a laptop.

Another bonus: CIS's extremely low power consumption means that it can run off battery power or a powered USB port. However, as our tests of three CIS scanners (the Canon

CanoScan FB 320P, the Microtek SlimScan C3, and the Mustek Plug-n-Scan A3 EP) demonstrated, image quality and color fidelity are no match for even inexpensive CCD-based units. If you plan on scanning mostly text, then one of the new CIS scanners may prove enough. But for frequent photo scanning, stick with CCD for now.

SEGMENTED MARKET

Though there is considerable overlap, flatbed scanners generally fall into three categories: home, business, and professional graphics.

Review Criteria

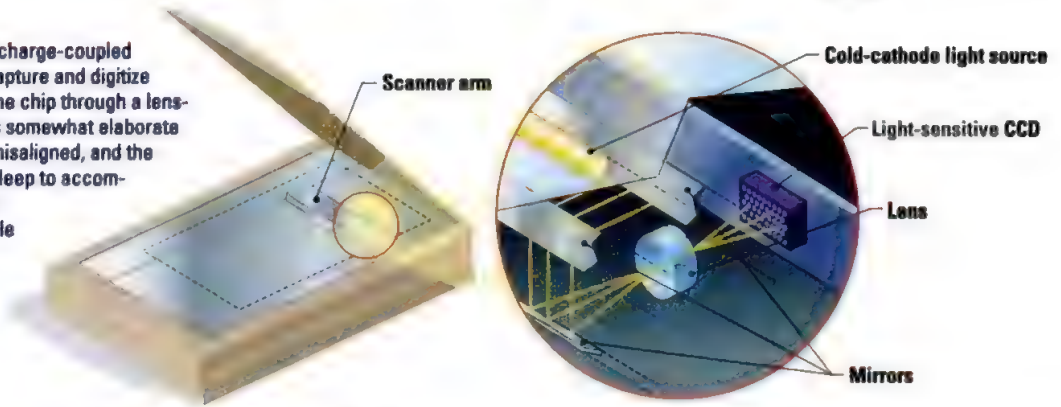
We tested color flatbed scanners that deliver 30-bit color depth or better and that sell for less than \$800. The largest vendors were invited to send more than one product from each line. One of the larger vendors, Storm Technology, was between product cycles and opted not to participate.

Adara Technology Inc.	156	Heidelberg CPS	162	Microtek Lab Inc.	170	UMAX Technologies Inc.	184
AGFA Division, Bayer Corp.	156	Hewlett-Packard Co.	167	Mustek Inc.	179	Visioneer Inc.	188
Arttec/Ultima International Corp.	160	INFO Peripherals	167	Pacific Image Electronics Inc.	183	Editors' Choice	149
Canon Computer Systems Inc.	160	MAG Technology USA Inc.	167	Plustek USA Inc.	183	Performance Tests and Image Samples	151
Epson America Inc.	162	Memtek/Memorex Products Inc.	170	Sceptre Technologies Inc.	184	Summary of Features	178

CCD vs. CIS: Where the New Technology Hits

CCD Scanners

Traditional scanners use a CCD (charge-coupled device) semiconductor chip to capture and digitize image data, which is passed to the chip through a lens-and-mirror optical system. In this somewhat elaborate system, the optics can become misaligned, and the scanner needs to be somewhat deep to accommodate the mechanism. But CCD technology is still the most reliable for producing the best-quality scans—assuming that the best components are included.



Home/SOHO scanners target casual, nonprofessional users whose final output is to an ink jet printer or a home page on the Web. Most are inexpensive (\$85 to \$200) letter-size scanners that offer easy parallel-port or USB connectivity, and won't accommodate ADFs (automatic document feeders) or transparency adapters for scanning slides and negatives. In this roundup, we were impressed with the Artec ViewStation (\$85), the INFO Peripherals ImageReader (\$140), the MAG Innoscan (\$150), the Pacific Image ScanAce (\$140), and the Visioneer PaperPort OneTouch (\$200)—an Editors' Choice in this category.

Business users also value simple setups and ease of use, but they are more concerned with issues like speed and throughput, durability, robust OCR (optical character recognition) software, and batch scanning. Business scanners often have legal-size beds, as well as the ability to add an ADF. Businesses typically use scanners for producing newsletters, creating presentations, archiving documents, and capturing images for the Web. Scanners in this class (represented by six units here) cost between \$200 and \$600 and come in a mix of SCSI, parallel, or even USB interfaces (such as our Editors' Choice unit, the HP ScanJet 6200C).

Graphics professionals judge flatbed scanners on two things: image quality and speed. They require the ability to calibrate (match) colors accurately, maintain a sharp image, and support a relatively high optical resolution to enable scaling up (enlarging) originals to a desired output size.

And since the scanner gets used all day long, speed—and hence a SCSI interface—is a must. Also, software drivers for profes-

sional graphics use offer more precise tools for fine-tuning image quality and color. In this roundup, the high-end class of machine is typified by the Epson Expression 636 (\$700), our Editors' Choice in the graphics professional category.

Most graphics scanners can use a transparency adapter to scan a variety of original sources (slides, negatives, and so on). The AGFA DuoScan and Microtek ScanMaker 4 have built-in drawers for transparencies.

SPECS AND A GRAIN OF SALT

Don't make the mistake of selecting a scanner based primarily upon the three numbers that manufacturers tout to entice buyers: optical resolution, interpolated resolution, and color bit depth. In the numbers game, more is usually perceived as better. But in real-world scanning, high resolution, and higher bit depth may be unimportant to most users. Here's why.

The figures vendors cite for *interpolated resolution* (many manufacturers boast of software-enhanced resolutions of 4,800-by-4,800, or even as high as 9,600-by-9,600) are marginally useful for line-art scans and precious little else, and they can be safely ignored. *Optical resolution* (the figure we cite at the beginning of each review) is the more useful figure. It refers to the number of points or dots that can be scanned per inch (reported in dpi); the more points, the greater the detail.

Although a scanner should have enough resolution to capture details in the original

faithfully, unless you plan to enlarge a small original to a larger print or wish to scan 35-mm or similarly small negatives or transparencies, you probably don't need a scanner with an optical resolution higher than 300 by 600 dpi—a threshold all of the scanners we tested meet or exceed. Sharpness is determined by the quality of the optics and the precision of the scanning mechanism, more so than by resolution, and scan resolutions that are unnecessarily larger than your intended output will slow your entire system to a crawl and gobble up hard disk space.

The third spec is *color bit depth*, typically 24-, 30-, or 36-bit. Theoretically, higher color bit numbers mean that more details in highlights and shadows can be captured accurately. Most inexpensive scanners can scan internally in 30- or 36-bit color, but when the image is converted to digital data, it is sampled down and saved as a 24-bit file. Manufacturers justify their greater bit depth capture by explaining that the scanner's firmware automatically analyzes the image file on the fly and selects the best 24 bits of color to save. While it's difficult to state definitively that bit depth significantly increases image quality, the top two scanners in our juried evaluation tests (the HP ScanJet 6200C and Microtek ScanMaker 4) are indeed 36-bit devices.

MOVING BEYOND RESOLUTION

Other considerations should probably carry more weight for home and business users than resolution or bit depth. If your

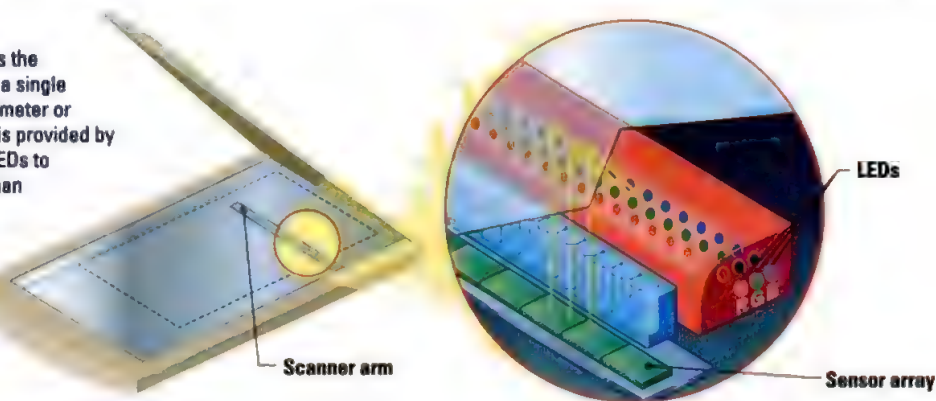
Our Contributors: DANIEL GROTTA, M. DAVID STONE, and SALLY WIENER GROTTA are contributing editors of *PC Magazine*. RODERICK A. BELTRAN is an editorial researcher at the magazine. DON LABRIOLA is a frequent contributor, and DENIS TOM is a freelance writer. S. JAE YANG was the project leader, and JAMIE M. BSALES was the senior associate editor in charge of this story.

—and Misses

HARDWARE Desktop Scanners

CIS Scanners

A CIS (contact image sensor) scanner replaces the cumbersome optical reduction technique with a single row of sensors, which is positioned only a millimeter or two below the original document. Illumination is provided by a closely packed row of red, blue, and green LEDs to create white light. LEDs draw far less power than the bulbs used in CCD scanners. CIS also eliminates the elaborate housing typical of CCD systems, so a scanner can be thinner than a laptop. CIS resolution, however, is presently limited to 300 or 600 pixels per inch, and image quality and color fidelity need to be improved.



originals are larger than letter-size, you'll need to confine your search to one that features a legal-size copyboard (four of the units here), or even the tabloid-size unit (11-by-17) found on the Mustek Plug-n-Scan A3 EP. Is speed important to you? A rough rule of thumb is that SCSI scanners are usually faster than USB devices, which are faster than parallel scanners.

Six of the units we tested let you add an ADF (ranging widely in price from \$150 to \$500). Ten have a convenient software copy function that turns your scanner and

printer into a personal photocopy machine. And some, such as the HP ScanJets and Visioneer PaperPort OneTouch, combine a point-and-scan interface with a hardware feature that automatically launches the software with the touch of a button.

Consider the scanner's software package. Most of the models here offer a novice-friendly point-and-scan driver interface that will have you scanning in no time. More advanced users will want a package that offers low-level control over a wide range of image attributes. In this roundup,

kudos goes to the AGFA DuoScan, Epson Expression, HP ScanJet 6200C, and the Microtek and UMAX entries for particularly powerful software tools. Another important software piece is the OCR (optical character recognition) program that comes bundled with the unit. The best we tested was the Visioneer OneTouch.

Whatever your task—be it images, text, or a combination—there's a scanner here to match your needs. And chances are, you'll pay a lot less for it than you would have a year ago.

Editors' Choice

- *Business:* HP ScanJet 6200C
- *Home/home-office:* Visioneer PaperPort OneTouch
- *Graphics professional:* Epson Expression 636 Artist 2



Though the new CIS scanners are compact and affordable, CCD still rules the day when it comes to quality.

Users looking for a sturdy, easy-to-use scanner for day-to-day use need look no further than the HP ScanJet 6200C (\$400 street), our Editors' Choice for business. The intelligently designed unit offers both SCSI and USB connectivity, and its software driver combines the best of both worlds: Casual users get one-button scans with no intervention needed, while more sophisticated users will find advanced image controls just a mouse click or two away. Output was among the best in the roundup.

For lighter-duty home and home-office buyers, our Editors' Choice is the Visioneer PaperPort OneTouch (\$200 street, or \$170 after rebate). This was the best document scanner we tested: Visioneer's OCR engine performed the best on our test. The OneTouch is also a commendable image scanner, showing sharp images with respectable retention of detail. For no-fuss, text-intensive scanning, the OneTouch can't be beat. Honorable mentions in this class go to the MAG InnoScan

DTS-3080 (\$150), which delivers good image quality and a family-friendly software bundle; and the Artec ViewStation AM12E (\$85), an ultra-affordable unit whose image quality compared favorably with that of much more expensive units.

Graphics professionals who need uncompromising image quality and complete image control should look to our third Editors' Choice, the Epson Expression 636 Artist 2 (\$700). You can choose to use either the simple point-and-scan driver interface or the more robust SilverFast driver, a powerful, precise tool for fine-tuning all aspects of the scanned image. On our tests, photos were razor-sharp, colors were accurate and vibrant, and the scanner accurately captured faint skin blemishes on our test photo that other scanners missed. A close second to the Epson, and deserving of honorable mention, is the Microtek ScanMaker 4 (\$700). Microtek's ScanWizard driver is powerful yet approachable, and scanned images showed good tonal variation and fine detail. We have a love/hate relationship with the slide-out transparency adapter; however, while the built-in drawer saves you from having to buy a separate adapter, we found it can introduce dust into the scanner's innards, which must then be cleaned periodically.

THE SCANNER THAT ATE THE TRANSPARENCY ADAPTER!

Scan reflective prints on the scanner's upper bed...



...or transparencies and negatives from the internal film tray

Introducing the ScanMaker® 4, the all-in-one scanner from Microtek, the most trusted name in desktop scanning. The same innovators who brought you the ScanMaker® III (winner of PC Magazine's Editors' Choice and Best of 1997 awards) now bring you this incredibly fast, dual-media color scanner.

The ScanMaker 4 features Microtek's own patented *Emulsion Direct Imaging Technology™* (E.D.I.T.™). Unlike a conventional flatbed scanner which scans film with an attachable transparent media adapter (usually an accessory item purchased separately), the ScanMaker 4 captures images directly from the surface of film transparencies or negatives — *internally*. No more light refraction problems. No more annoying Newton rings. Just amazingly sharp images loaded with detail. Photographic prints, illustrations, or documents up to 8.5" x 14" can be scanned on the scanner's upper bed.

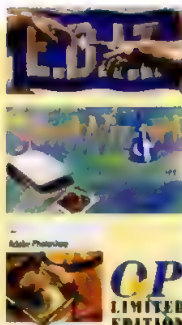
The scanner's 36-bit color depth (input and output), 600 x 1200 dpi optical resolution (up to 9600 dpi enhanced) and superior optics deliver performance suitable for any company's graphic needs. And for quick, conflict-free installation, the ScanMaker 4 includes the **Adaptec 2902E PCI SCSI interface card**. All this and some great software for a suggested retail price of only \$699, it's almost like getting two scanners for the price of one.



ScanMaker 4

FEATURES

- Microtek's patented Emulsion Direct Imaging Technology™ U.S. Patent No. 5,574,274
- Full 36-bit color depth — input and output
- 3 long-life cold cathode lamps
- Adaptec 2902E PCI SCSI interface card
- 600 x 1200 dpi optical resolution / 9600 dpi enhanced
- Microtek's ScanWizard™ scanner controller
- Adobe Photoshop LE image-editing software
- MetaCreations™ Painter™ 5
- Caere OmniPage Limited OCR software for scanning text



Painter 5

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PERFORMANCE TESTS

Desktop Scanners



Though prices for color flatbed scanners have fallen dramatically, we found that image quality—even on sub-\$100 units—is good enough for most users. The new ultracompact CIS scanners were somewhat disappointing.

Evaluating image-processing devices like scanners is a balancing act calling for highly technical low-level measurements as well as careful observation by the human eye. For this story, we report data on a number of characteristics that determine how well a scanner captures images, in addition to scores on a series of jury tests that gauge how actual users perceived those images.

On perusing the data, you'll find that our jury test results don't always correlate with the objective measurements. This is because the two testing approaches were devised to complement one another and not necessarily confirm one another. While the devices we used for objective measurements focused on a scanner's ability to capture details accurately, jurors tended to be more sensitive to color. Two examples are the Microtek ScanMaker 4 (our jury favorite on plain-paper output) and the Plustek OpticPro 9636P+ (tops in the photo-paper evaluation). Our jury panel liked these scanners' ability to reproduce a good color range covering all the hues in the original

target, despite their less than stellar scores on our Uniformity and Black Noise tests.

Also, our jurors were universally unimpressed with the photo-image capabilities of the three CIS units in this roundup. On our plain-paper rankings, the Canon CanoScan FB 320P placed 24th in a field of 25; the Microtek SlimScan C3 placed in the bottom third; and the Mustek Plug-n-Scan A3 EP placed dead last. Still a young technology, CIS may eventually match traditional CCD charge-coupled device arrays, but it still has a ways to go.

While jury test results are important because scanned images must ultimately look good to the human eye, objective measurements highlight flaws that can potentially cause visible problems.



Our 5-by-7 original has tough high-lights, shadows and colors.

A case in point is the HP ScanJet 6200C's ghosting problem. The jurors did not find the problem significant, ranking the 6200C second on photo paper and third on plain paper. But when we tweaked the output controls as high-end graphic designers would, the ghosting problem became amplified and very apparent. Another example of a real problem our jurors couldn't see was the color registration error in the Microtek ScanMaker E3 Plus PC SCSI, which ranked fourth best on photo paper. The color registration problem may become more pronounced when the image is enlarged.

A good indicator of a scanner's ability to capture details is its optical resolution, and scanners

are often rated by this attribute. Our measurements yielded no surprises here, as every scanner fell in line with others in its resolution class. The Mustek Paragon PowerPro 1,200-dpi scanner,

Scanner	Jury Ranking		Resolution (lino pairs/mm)	Uniformity Error (gray levels)	Dynamic Range	Black Noise	Ghosting Error (gray levels)	Color Registration Error (pixels)
	Plain Paper	Photo Paper						
Adara MegaStar I	12	5	6	6	2.5	2.8	2.1	1.13
AGFA DuoScan T1200	23	18	10	6	2.0	1.3	2.4	0.55
Artex ViewStation AM12E	4	14	7	10	2.2	6.4	28.5	0.25
Canon CanoScan FB 320P	24	23	4	4	2.4	2.9	2.3	1.12
Canon CanoScan 600	14	7	9	8	2.5	1.2	3.3	0.34
EPSON Expression 636 Artist 2	2	22	10	7	2.3	4.9	7.1	0.18
Heidelberg Jade2	19	15	8	5	N/A	1.2	10.7	0.64
HP ScanJet 4100C	10	10	3	5	2.3	1.5	2.7	0.61
HP ScanJet 6200C	3	2	10	9	1.8	13.8	13.2	0.58
INFO Peripherals ImageReader UltraPro	8	6	8	6	N/A	2.3	9.7	0.47
MAG InnoScan DTS-3060	9	9	8	8	2.5	4.2	7.9	1.17
Memtek Memorex SCF-9650P 3D	22	21	3	7	2.2	3.5	4.3	1.16
Microtek SlimScan C3	20	17	4	19	N/A	2.0	1.8	0.93
Microtek ScanMaker E3 Plus PC SCSI	6	4	4	2	2.4	1.7	10.1	2.46
Microtek ScanMaker 4	1	16	10	8	2.2	3.9	7.8	0.29
Mustek Plug-n-Scan A3 EP	25	24	5	7	1.5	1.8	0.6	0.39
Mustek Paragon PowerPro	11	8	16	10	1.9	1.2	0.7	0.27
Pacific Image ScanAce 1236p	7	20	10	9	2.1	6.4	14.6	0.94
Plustek OpticPro 9636T	17	3	9	7	1.9	5.0	9.4	0.17
Plustek OpticPro 9636P+	13	1	9	7	1.9	5.7	12.0	0.14
Scepter S1200 Ultra High Performance Scanner	21	19	9	8	2.0	1.4	7.9	0.39
UMAX Astra 610P	18	12	4	5	2.2	0.7	0.6	1.17
UMAX Astra 1200S	15	11	7	3	N/A	7.0	13.2	0.61
UMAX Astra 1220U	16	25	9	8	2.1	0.9	6.5	0.59
Visioneer PaperPort OneTouch	5	13	8	4	N/A	2.7	13.0	0.36

▲ In our Jury Ranking, the HP 6200C was placed near the top, on both plain paper and glossy photo paper.

On our low-level tests, only the AGFA DuoScan T1200, Epson Expression 636 Artist 2, and UMAX

Astra 1220U produced results that were all within the acceptable range. Every other scanner showed at least some flaws. On our Uniformity test, any variation above ten gray levels would be unacceptable. The Microtek Slim-

Scan C3 (a CIS-based unit) produced a disturbingly high gray-level variation across the page.

A Dynamic Range score of 2.0 is sufficient for mainstream use. The Adara MegaStar I and the Canon CanoScan 600 produced

the best Dynamic Range scores in the roundup, while the Mustek Plug-n-Scan A3 EP performed unacceptably at 1.6.

Any Color Registration fault of more than a pixel may potentially cause problems.



Hey, Big Fish — outgrowing your pond?

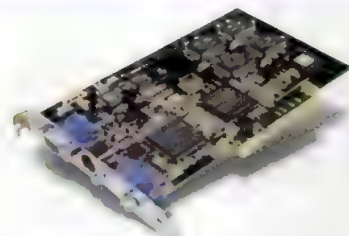


Multiple monitors give you more space.

Thinking about upgrading your monitor? Here's something they didn't teach in school — going from your current 17-inch to a pricey 21-inch is expensive, and it doesn't really give you that much extra room. This is what the smart fish do — get a second 17-inch monitor and use an Appian Graphics card to unite your two screens in a single display. Even figuring the cost of the card and the second monitor, you'll save yourself money. And you'll have a much bigger expanse for you to work and play. Appian Graphics is the leading supplier of multiple-monitor cards, and our products are optimized for Windows 98. To find out more, swim on over to www.appiangraphics.com/fish or call toll-free 1-877-7APPIAN



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PERFORMANCE TESTS/SCAN SAMPLES

however, was peerless in its brute resolving power of up to 16 line pairs per millimeter—6 more than the next-best competitor.

In measuring noise level and dynamic range, we learned that some manufacturers enhance their scanners' apparent dynamic range by artificially stretching the difference between black and white levels. We gave several scanners an N/A on this test, because their firmware forced pixel readings of "near white" to saturated white. While such a technique makes images starker, it doesn't in the end yield a better dynamic range. A Dynamic Range score of 2.0 should be sufficient for most users, while a higher figure is recommended for scanning high-quality transparencies.

In evaluating our data for a purchase decision, a lot depends on how you plan to use the scanner. If it's for quick scans with minimal digital photo manipulation, consider the jury test results and ease of use as discussed in the reviews. If you're a graphics professional, any flaws we discovered in our objective measurements should concern you.—*Analysis written by S. Jae Yang*

How We Tested

We subjected this year's roundup of flatbed scanners to a suite of inspection tests that isolate and evaluate the optical system, the precision of the mechanical parts that move the CCD array under the platen (or scanner bed), and the inherent noise in the internal circuitry and its effect on the overall scan. For this, we enlisted the assistance of KDY Inc. (603-598-2500; www.imagexpert.com/company.hmx), a firm based in Nashua, New Hampshire, which

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specializes in the analysis of high-end scanners and other image-processing devices.

With each scanner, we scanned KDY's test target at the scanner's highest optical resolution and in the highest color mode. We then sent the results to KDY, where they were analyzed using the company's ImageXpert software tool, which automates the analysis of image quality at the subpixel level. Each scanned target was sent to

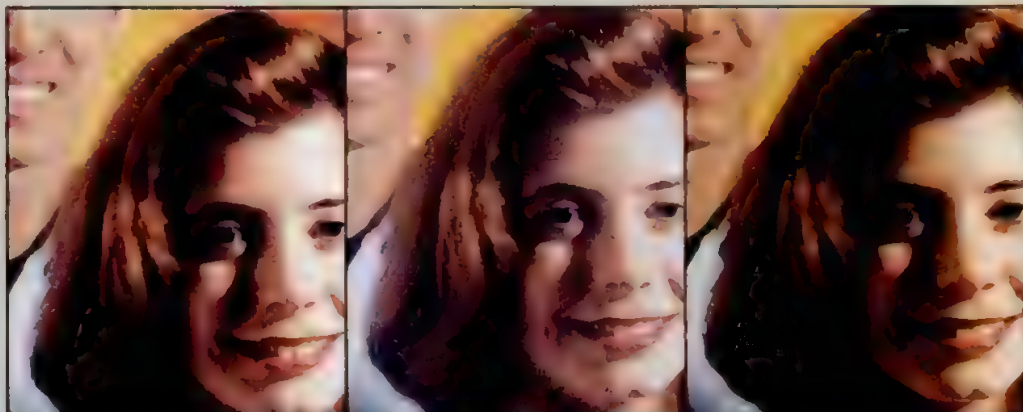
KDY as an RGB TIFF file named with a special code number to ensure product anonymity. In addition to these objective measurements, we used a panel of jurors to rate the quality of images captured with each scanner.

As a test-bed, we used Pentium II/300-based NEC Direction SPL 300 systems, each configured with 64MB of RAM. To provide consistent color display for reviewers and testers, we calibrated each system's 17-inch NEC C700 monitor using the Xrite DTP92 colorimeter and OptiCal monitor-calibration software, based on a luminance model of D65 and a gamma value of 2.2. For all test scanning, we invoked the scanner's Twain driver from Adobe Photoshop 5.0 and set it up with an appropriate profile for the monitor.

For the **Jury Test**, we captured a 5-by-7 photo with each scanner using its highest optical resolution. We also enabled auto-exposure settings and high-quality scan presets, if available. We used an HP DeskJet 722C color ink jet printer to output the image from each scanner onto both plain and glossy photo paper. Each juror was asked to rank the two sets of images, drawn from 25 scanners, in the order of best to worst by executing the insertion-sort routine (described in Inside PC Labs on page 29 of this issue).

Our Results

This photo image, printed on plain ink jet paper, was used by our jury panel to rate each scanner's image-reproduction abilities. Look for natural skin tones and good details in the highlight and shadow areas, with no posterization or jagged edges.



Adara (\$750); 400 x 800; Jury rank: 12

AGFA (\$699); 600 x 1,200; Jury rank: 23

Artec (\$85); 600 x 1,200; Jury rank: 4



Canon FB 320P (\$80); 300 x 300; Jury rank: 24

Canon 600 (\$300); 600 x 1,200; Jury rank: 14

Epson (\$700); 600 x 600; Jury rank: 2

Heidelberg (\$500); 600 x 1,200; Jury rank: 19



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PERFORMANCE TESTS/SCAN SAMPLES

We averaged the ordinal values that each scanned image received from the jurors and then determined the final ranking.

The **Resolution** test uses closely spaced horizontal and vertical lines that must not be broken or touching each other. The results indicate how many line pairs can be resolved per millimeter.

The **Uniformity** test requires that the average gray level must be identical at various points across the scanned target. The most uniform scanners achieved ratings below five gray levels. Poor lamp quality, an old lamp, mechanical misalignment, and even dirt on the scanner's platen can cause nonuniform gray levels in the output.

Dynamic Range represents the scanner's ability to register both a wide tonal range and the granularity of adjacent tonal values. The dynamic range is manifested in the accuracy of captured details and in the smoothness of gradations between highlights and shadows. Also called the *signal-to-noise ratio*, dynamic range is derived by computing the difference between the whitest and the blackest gray levels captured by the scanner (the *signal*) and dividing that value by the standard deviation in the white signal (the *noise*). The results are expressed on a logarithmic scale.

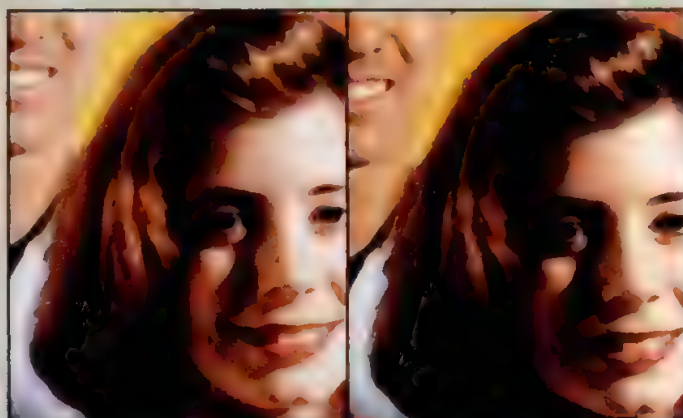
The **Black Noise** test measures aberrant noise introduced by the internal circuitry, as well as flaws in and contamination of the optical system. Noise is defined as the standard deviation, measured in gray levels, of all the pixels in the sample; these were scanned from a 100-percent-black test target.

Ghosting is a faint false image rendered next to the actual image. This is caused by an internal reflection or by flares transferred onto the CCD. On our test, we scanned a white square with a

black background and then zoomed in closely, which allowed us to see the ghost falling outside the bounds of the square (assuming the scanner had this problem). The results are reported in terms of gray-level deviation in the ghosted area.

The **Color Registration** test measures the accuracy of the alignment of the CCD array's red, green, and blue planes. Proper alignment is necessary to produce clean edges between colors. Upon close inspection, a rainbowlike halo (or *chromatic aberration*) is visible next to fine lines on scanners with poor registration. The results, presented in pixels, describe the maximum distance between any two misaligned planes.

Special thanks to Yair Kipman of KDY and to Glenn Menin for technical consultation on test methodologies and analysis of data.



HP 4100C (\$200); 300 x 600; Jury rank: 10

HP 6200C (\$400); 600 x 1,200; Jury rank: 3



INFO (\$140); 600 x 1,200; Jury rank: 8

MAG (\$150); 600 x 1,200; Jury rank: 9

Memtek (\$90); 300 x 600; Jury rank: 22

Microtek 4 (\$700); 600 x 1,200; Jury rank: 1



Microtek C3 (\$100); 300 x 600; Jury rank: 20

Microtek E3 (\$150); 300 x 600; Jury rank: 6

Mustek A3 (\$220); 300 x 600; Jury rank: 25

Mustek Paragon (\$750); 1,200 x 4,800; Jury rank: 11

PERFORMANCE TESTS/SCAN SAMPLES



Adara MegaStar I

Tabloid-size bed; 400-by-800-dpi optical resolution; 36-bit color depth; SCSI interface; \$750 street. Redondo Beach, CA; 310-536-3000; www.adara.com; 500 at www.pcmag.com/infolink.

● The tabloid-size Adara MegaStar I is a good choice for high-contrast professional applications (such as scanning schematics, blueprints, or X-ray transparencies) and for Web and business users who need an affordable tabloid-size scanner. Our hands-on evaluation also suggested a machine well suited for scanning color photographs.

This scanner's solidly built chassis boasts a sturdy drive mechanism. Installing the interface card and application software was painless, and the scanner's comprehensive utility AdaraScan is one of the most powerful and easy-to-use Twain drivers we've seen. Its broad functionality includes seven effects filters, flexible color controls, gray scale filters, and more. The scanner also offers a 12-by-17-inch scanning bed that can handle oversize documents.

The MegaStar's default settings pro-

duced excessive contrast and blocked-up shadows on our tests, but a small adjustment of the contrast and brightness generated pleasing color output with superior detail across the tonal range. Although a bit undersaturated, the tweaked output was still good enough to earn a fifth-place jury ranking (out of our field of 25) when printed on glossy photo stock. Objective-test results were average across the board.

The MegaStar's generous software bundle seems most appropriate for SOHO applications. It includes Ulead's Web-friendly graphics-editing suite, PhotoImpact, which provides a GIF animator, screen-capture and image-viewer utilities, photo album software, and a richly featured image editor. Also bundled is DocuMagix's PaperMaster, a virtual filing-cabinet program that lets you organize, find, fax, and copy scanned images. Caere's OCR package, OmniPage LE, rounds out the software.

If you need an 11-by-17-inch workhorse for daily use, especially for high-contrast scanning, consider the MegaStar I.

—Don Labriola

AGFA DuoScan T1200

Legal-size; 600 x 1,200; 36-bit; SCSI; \$699 list. Wilmington, MA; 888-281-2302, 978-658-5600; www.agfahome.com; 501 at www.pcmag.com/infolink.

● The AGFA DuoScan T1200 is aimed at professional graphic artists, and it's priced accordingly. Unfortunately, it falls short on image quality compared with others in its price range, despite an impressive set of adjustable controls in the software driver.

AGFA's FotoLook driver offers a set of predefined curve functions that perform a number of specialized color-manipulation tasks, such as adding or subtracting particular colors (like red or gold). You can mix these curves and turn each one on or off. Even a casual user can easily work through the list to see what each choice does, and advanced users will also find more sophisticated controls. There's more here than you would expect in a driver.

We have mixed feelings about the slide-out transparency tray, however. Although it eliminates the need for a transparency adapter, it offers a path for dust to get

DLP VS. LCD: A DIGITAL DIFFERENCE YOU CAN SEE AND FEEL.

By S. E. Easter

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Incredible digital images are composed of 16.7 million digitally correct colors.

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100% digital display system is smaller and lighter than LCD, enabling high performance in projectors as light as 7 pounds.

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Unique digital design produces "digital light," more of which ends up on the screen than with traditional LCD, over 600 lumens.

DLP technology has pioneered a new class of extremely bright ultraportables. A projector weighing under 10 pounds can now deliver over 600 lumens of digital light.

system. DLP technology is able to achieve higher levels of brightness through its all-digital design, producing more usable light than traditional LCD systems for brilliant, lifelike displays.

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heavy optics, DLP technology allows a smaller, more compact optical system that delivers phenomenal visual impact.

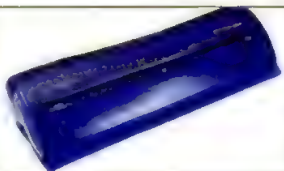
Brightness is a critical performance factor in any projector and an important function of the DLP optical

Beyond Flatbeds: Unusual Scanning Solutions—Roderick A. Beltran



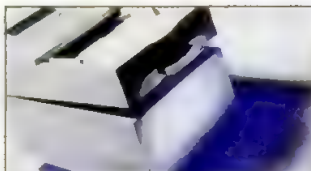
WordWand (\$99.95 list)

The WordWand (800-385-9263, www.wordwand.com) is a compact, highlighter-like device that attaches to your parallel port and lets you scan single lines of text into your PC's word processor. It works by converting the scanned text into a series of Windows-compatible keystrokes. Setting up the WordWand's interface and OCR engine was easy and fast. We found it especially useful when scanning books, because it can access the hard-to-reach area near the binding.



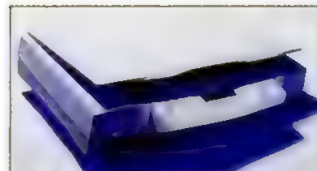
Visioneer PaperPort Strobe (\$229 list)

If you plan on scanning primarily text, you might want to pass on a flatbed scanner and opt for a compact sheet-fed unit. One of the best we've found is the Visioneer PaperPort Strobe from Visioneer Inc. (800-787-7007; www.visioneer.com). Setup was a snap and image manipulation was a breeze. Text sent to the PC for OCR translation was flawless. Quality of photo and graphics images was a little grainy but very presentable. tktktktktktktktkt



Avison ScanCopier (\$350 street)

This clever device from Avison Inc. (800-895-8999; www.avison-labs.com) is a scanner that turns almost any standard desktop printer into a personal copier. With 30-bit scan capability, it can generate 300-by-600-dpi copies from a wide range of standard laser and ink jet printers. It comes with Pajis and MGI PhotoSuite, and it produces excellent output quality on most printers (better than we've seen on analog desktop copiers), with crisp images and only limited blurring.



HP 9100C Digital Sender (\$3,599 list)

The HP 9100C Digital Sender from Hewlett-Packard Co. (800-752-0900; www.hp.com) is a networkable office device that lets you scan, copy, or send out color paper documents without having to use a PC. Just insert the sheet and tell the Digital Sender to either print out a copy (you'll need an attached printer for this), send a copy to someone via e-mail or fax, or just scan it into OCR. The maximum scanning speed is approximately 15 ppm, and the ADF has a 50-page capacity.

under the platen. The glass lifts off for cleaning, but AGFA advises against that.

On-screen image quality on our tests was acceptable but not outstanding. Most details were fine, but in adjusting the image to show detail in dark areas, we wound up with somewhat faded colors. An advanced image-editing package such as Photoshop will let you apply changes to parts of the image instead of the whole image only, which might avoid such problems. When we tested using just the included driver, however, our jury placed the DuoScan's images far back in the hunt—behind competitors such as the HP ScanJet 6200C and Microtek ScanMaker 4.

On our objective tests, the DuoScan showed good results on our Resolution, Ghost, and Color Registration tests, and its Dynamic Range score of 147.9 put it in the top ten. Bundled software includes ColorTune 3.0, a color-management utility that lets you create ICC profiles.

Alas, less than ideal image quality and a relatively steep price make it hard to give the DuoScan an unqualified recommendation. Although this scanner is worth considering for professionals who use a separate image-editing package, the DuoScan is not the hands-down winner you might expect at this price level.—*M. David Stone*

Artex ViewStation AM12E

Letter-size; 600 x 1,200; 30-bit; parallel-port; \$85 street.
Newark, CA; 510-739-0800; www.artexusa.com; 502 at www.pcmag.com/infolink.

● The Artex ViewStation AM12E is priced like a toy but performs like a champ. This

\$85 wonder boasts competitive output quality and a raft of nifty features. Image quality isn't the best in the roundup, but it's terrific for the price and should easily satisfy most home and home-office users.

Installing the scanner was refreshingly simple; the setup utility even reminded us to enable our parallel port's higher-speed EPP mode. The driver offers a broad selection of controls and filters and can automatically route scans to a printer, a fax, a disk file, an e-mail message, or the clipboard. It also supports batch scanning, which lets you scan several noncontiguous areas on an original document at the same time. There's also a one-touch AutoScan button, which automatically initiates a scan using the most recent settings—a handy feature when you're using the scanner as a makeshift photocopier. Our only complaint was the package's near-total lack of printed documentation, which made it harder than necessary to learn the otherwise easy-to-use software.

With the default settings, on our tests the ViewStation produced high-contrast output with little detail in the lower tonal ranges. But simply increasing the gamma setting reduced this problem, resulting in brilliant, accurate output that captured an impressive fourth place in our plain-paper jury evaluation. Performance on most of our tests was middle-of-the-pack. Our tests did reveal poor dynamic range and a high degree of ghost error, but these can be overlooked by the average home user.

Bundled software includes the Twain driver, ixl's Photo Scanner suite, the Seris-

SPC suite, Xerox's TextBridge Classic, and Microsoft Internet Explorer. These offer a wide range of one-click image-editing tools, plus a media-clip librarian and an assortment of wizards that let you easily incorporate scanned images into presentations, photo albums, and Web pages.

The Artec unit's bargain-basement price, easy-to-use software, and surprisingly good output make it a great buy for families and home businesses.—*DL*

Canon CanoScan FB 320P, 600

FB 320P: Letter-size; 300 x 300; 30-bit; parallel-port; \$80 street. 600: Letter-size; 600 x 1,200; 30-bit; SCSI; \$300. Costa Mesa, CA; 800-652-2666, 714-438-3000; www.csi.canon.com; 503 at www.pcmag.com/infolink.

● Charge-coupled device versus contact image sensor: That's the story with these two Canon scanners. The CCD-based Canon CanoScan 600 produces acceptable though not remarkable image quality. The CIS-based Canon CanoScan FB 320P is ultracompact—2.5 by 10 by 15 inches (HWD)—and very affordable, but as with others of its ilk, image quality is substandard.

On-screen scans produced with the CanoScan 600 were good though not class-leading. The most notable flaw was a slight loss of tonal variation bordering on posterization. Our jury tests put the scanner's printed output in the middle of the pack on plain paper and at a commendable seventh out of 25 on photo paper. OCR results on our informal tests, using Xerox's TextBridge Plus, was among the best in the group. Other objec-

- 
1. Start image editing software
 2. Choose "file acquire"
 3. Pre-scan page
 4. Set scan area
 5. Set resolution
 6. Set scan mode
 7. Scan page
 8. Close TWAIN
 9. Save file
 10. Close image editing application
 11. Start e-mail package
 12. Start new message
 13. Choose "attach file"
 14. Locate saved file on hard disk

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Let's face it, most scanners are not as simple
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tive-test results were average.

The driver tries hard to look like a 3-D electronic toy, complete with plastic-looking buttons. In the process, it violates some basic Windows rules; for example, it turns the menu bar at the top of the screen into a button-activated pop-up list. But it does offer some intuitive image-adjustment tools, such as midtone brightness adjustment, shadow brightness adjustment, and color adjustment (like the ability to add more green or yellow). These are viewable via a small thumbnail preview window—so small, in fact, that you may need to check the full-screen window anyway. Novices will find the controls simple to use, while experts will find them useful but limited. All in all, the CanoScan 600 is an acceptable unit, but we prefer similarly priced units from HP and Microtek.

The CanoScan FB 320P is one of the new breed of scanners that use CIS technology (or what Canon calls *LIDE*, for LED Indirect Exposure). Though we love its small size (the size of a laptop PC), image quality is mediocre. Using the default settings, we found images too dark and the contrast too pronounced. Although we were able to eliminate these problems by adjusting driver settings, we still saw a loss of fine detail when comparing the device with other 300- by 300-dpi scanners. Our jury ranked the CanoScan FB 320P near the bottom for both its plain-paper and photo-paper output. Objective-test results were also disappointing. Good scores on our Uniformity Range and Ghost tests were offset by poor ones on our Resolution, Dynamic Range, and Color Registration tests (on which the scanner was as much as 1.12 pixels off, ranking among the worst we tested).

The CanoScan FB 320P's driver, similar to that of the CanoScan 600, includes the same image-adjustment features; the main difference is that it adds a standard Windows menu bar across the top. Bundled software includes Xerox's TextBridge Plus. The scanner's cover isn't heavy enough to hold down a lightweight piece of paper and keep it flat, however: On our OCR tasks, for example, we saw shadow effects in places where the lid wasn't holding down the page. All told, the CanoScan FB 320P is a lightweight in every sense.—MDS

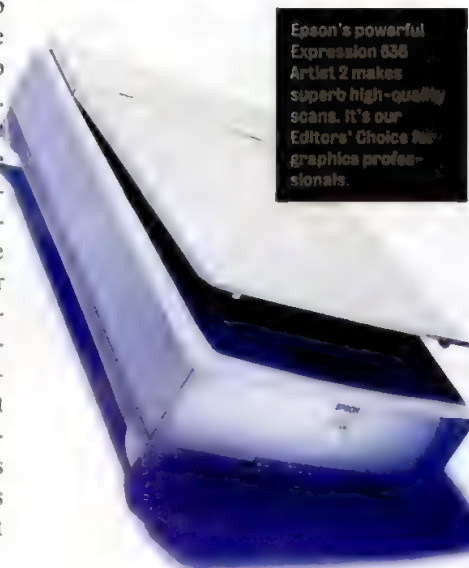
Epson Expression 636 Artist 2

Letter-size; 600 x 600; 36-bit; SCSI; \$700 street. Torrance, CA; 800-463-7766, 310-782-0770; www.epson.com; 504 at www.pcmag.com/infolink.



The Epson Expression 636 Artist 2 is marketed to graphics professionals, and its superior image quality—among the best we saw in this roundup—won't disappoint. The driver, though a bit cumbersome for newcomers, is powerful, and the software bundle is ample and well-chosen. This unit is our Editors' Choice for graphics professionals.

Setting up the scanner presented no problems. The Twain driver can be set up either for fast clicking and scanning or for taking advantage of its sophisticated manual functions and corrections. One welcome feature is closed-loop calibration (available with only five units we tested), which is one of the best ways to match colors between your scanner and your printer.



Epson's powerful Expression 636 Artist 2 makes superb high-quality scans. It's our Editors' Choice for graphics professionals.

But where the Expression 636 really shines is in its industrial-strength SilverFast interface, which contains extensive and extremely precise tools for fine-tuning image quality and color. SilverFast isn't easy to use, but it can achieve results comparable to those of much more expensive scanners.

If you take the time to master the complex drivers, either one will reward you with superb scans. The Expression 636 produced the best on-screen images we saw: Photos were razor-sharp, colors were accurate and vibrant, and the scanner accu-

rately captured faint skin blemishes on our test photo that other scanners missed. All scans were also exceptionally clean, virtually free of both electronic noise and dust. The scanner ranked second on our plain-paper jury tests, trailing only the Microtek ScanMaker 4. On our objective tests, the Expression 636's Resolution and Color Registration scores were both very good.

An excellent choice for production-level graphics applications, the Epson Expression 636 Artist 2 is fast, robust, and capable of very high-quality scans once you're comfortable using the driver. —Daniel Grotta and Sally Wiener Grotta

Heidelberg Jade2

Legal-size; 600 x 1,200; 30-bit; SCSI; \$500 street. Hauppauge, NY; 888-546-6265; www.linocolor.com; 505 at www.pcmag.com/infolink.

● The Jade series of scanners was originated by Linotype, a high-end scanner maker that recently merged with Heidelberg, another player in professional scanning systems. The company markets its Heidelberg Jade2 scanner to anyone who is "pretty serious" about color, focusing in particular on high-end graphic artists. While the powerful software driver is straightforward enough for even a novice, image quality wasn't up to the level we expected at this price.

Setting up this scanner is harder than it ought to be. The only paper instructions tell you to read the manual on CD—but this requires you to install Adobe Acrobat Reader first. There's also an ICC profile manager for optionally choosing a printer, monitor, and scanner profile for the Twain driver to use. Unfortunately, this program isn't self-explanatory, and the documentation, also available only in electronic form, isn't helpful.

The driver, called Color Factory Pro, goes a long way toward making up for the inconvenient installation. You'll find a raft of settings with handy thumbnail examples, including options for cast, contrast, color, brightness, and saturation. Many of the controls offer predefined choices that even a newcomer can use easily. Others are sophisticated tools that a graphics professional will appreciate.

In our labs, the on-screen image was more than acceptable, maintaining details through the entire range of brightness from light to dark. However, the

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AM = active-matrix color display DS = dual-scan color display

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Desktop Scanners

scanner didn't deliver fine-scale detail as well as some others (notably the Epson Expression 636 and HP 6200C). On our jury tests, the Jade2 scored below average on the whole, placing below the midpoint among the 25 units tested. Objective-test results, too, were middling. Using Xerox's TextBridge 3.0 (included), the Jade2 performed better than most on our informal OCR test.

Thanks to the powerful, well-thought-out driver, the Jade2 is worth considering, particularly if you want fine control over color. But be warned that getting a crowd-pleasing scan will take more work than just making a few minor tweaks to the defaults.—MDS

HP ScanJet 4100C, 6200C

4100C: Letter-size; 300 x 600; 30-bit; USB; \$200 street. **6200C:** Letter-size; 600 x 1,200; 36-bit; USB and SCSI; \$400. Palo Alto, CA; 800-722-6538, 415-857-1501; www.hp.com/go/scanjet; 506 at www.pcmag.com/infolink.



The HP ScanJet 4100C and 6200C generate quality scans with minimal work. The 4100C is optimized for the home or small office, while the 6200C is built for more heavy-duty business needs.

The 6200C is aimed, in particular, at business users who regularly scan documents and need high resolutions and a high degree of control over the image. Its combination of ease of use, power, and superior scan quality at an affordable price make it our Editors' Choice for business users.

During testing, we found dust under the platens of the 4100C and 6200C. We asked HP about this and were told that the production process for both units includes a test for dust. It's most likely that the dust crept in late in the game, when the early units that we tested were taken apart to upgrade the firmware—a procedure that normal units wouldn't have to undergo. Despite this dust anomaly (which contributed to poor scores on our Black Noise and Ghost tests), the 6200C delivered excellent image quality. This scanner's output was among the best in the roundup, offering extraordinarily fine-scale detail and maintaining the detail nicely over the entire range from light to dark. On our jury tests, the 6200C's output placed second on photo paper and third on plain paper. The unit also fared very well on our Resolution

test and acceptably everywhere else.

Like an automatic 35-mm SLR camera, the 6200C's driver offers the automation intelligence to let you simply click and scan, while giving advanced users manual control over sophisticated settings. You can adjust highlights, shadows, midtones, and colors. One particularly welcome touch: You can drag items off the Tools menu to make them free-floating toolbars or add them to the toolbar at the top of the window. The tools are easy to use, though novices might have to experiment initially



to figure them out. In our test scans, we opted not to use any of these tools, because the automated settings worked so well that tweaking wasn't necessary.

The comprehensive software bundle includes Adobe PhotoDeluxe for image editing and Caere's OmniPage LE for OCR. We also like HP's ScanJet Copy Utility, which turns the scanner and your printer into a one-touch convenience copier. Outstanding image quality and a no-hassle driver put the 6200C on the top of our list.

The entry-level 4100C showed above-average image quality in our labs. Fine details were appropriate for the resolution, and the scanner did a good job of maintaining these details even in dark and light areas. Our jury ranked this unit tenth (out of 25) for both plain-paper and photo-paper output. Objective-test results were midpack, though the 4100C trailed most others on our Resolution test.

The software offers almost no options for tweaking an image, though the built-in auto-adjustment will do a good-enough job for most users. This driver automates everything it can, even detecting the type

of item on the page (photo, line art, or text), and adjusts resolution, brightness, and other settings. You can, however, manually set options such as resolution and type of image.

The 4100C offers good value for the price and is a fine choice for home or SOHO use, but you may want to check out the similarly priced Visioneer PaperPort OneTouch, which our jury preferred.—MDS

INFO Peripherals ImageReader UltraPro

Letter-size; 600 x 1,200; 36-bit; parallel-port; \$140 street (\$140 with rebate). Campbell, CA; 800-777-3208, 408-538-2500; www.info-connection.com; 507 at www.pcmag.com/infolink.

● If you're looking for an easy-to-use scanner for your home or small office, the low-cost INFO Peripherals ImageReader UltraPro is a reasonable choice. It gives even the most inexperienced users the ability to produce good-quality color scans with little effort.

Setting up the scanner was easy, thanks to the quick-start pamphlet. The three small buttons located on the front of the scanner allowed for quick copying, faxing, or scanning with very little user intervention. Although there were few prescan and adjustment controls in the ImageCenter driver, most scans needed only the auto-exposure and higher-quality presets enabled to produce pleasing images. In case an image needs more tweaking, the scanner comes with Picture-Fun! image-editing software.

The photographic scanning quality of the UltraPro was undeniably good. Tonal accuracy and smoothness of transitions between blended colors were among the best in the roundup. The output on plain paper ranked eighth on our jury test—impressive for such an inexpensive unit. Scores on our objective tests were good to acceptable. For quick “no-brainer” image capturing with minimal financial commitment, the ImageReader UltraPro will do the job.—Denis Tom

MAG Innoscan DTS-3060

Letter-size; 600 x 1,200; 36-bit; parallel-port; \$150 street. Irvine, CA; 800-827-3998, 949-855-4930; www.maginnovision.com; 508 at www.pcmag.com/infolink.

● Scanner newcomer MAG Innoscan, a subsidiary of monitor maker MAG Innovi-



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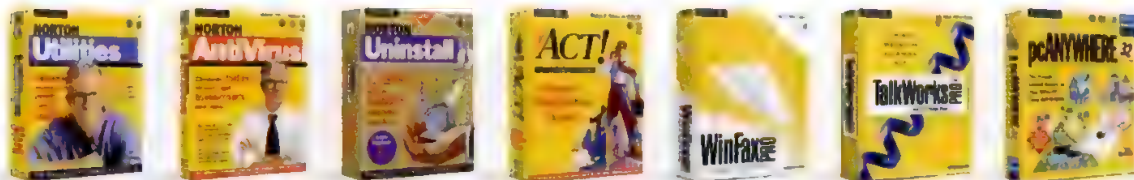


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Desktop Scanners

sion, delivers a nifty little SOHO scanner that boasts good output quality, slick software, and a competitive price. It's a good bet for families thanks to its ample software bundle and fun, intuitive driver interface.

Installing the scanner took only a few minutes: We plugged the DTS-3060 into the parallel port, attached our printer to its pass-through connector, and sat back while the plug-and-play software installed itself. The DTS-3060 is housed in a low-profile chassis that had no problems with dust or dirt trapped under the platen, as did some other low-cost units we tested.

The flexible Twain driver delivers an integrated graphical environment that looks like the cockpit of a sports car. Despite its exhaustive feature set, the driver's interface is one of the most intuitive we've seen, resembling a video game more than a scanning module. Converting a printed page into a text document is as simple as choosing a scanning preset, clicking the Scan button, and then dragging the resulting thumbnail to a word processor icon.

The DTS-3060's output was impressive for a low-priced scanner, ranking in the top ten on both plain and glossy paper. Scans of color photographs had a superior range of light, saturated colors, and fairly subtle detail. Achieving these results, however, required considerable tweaking—a process hampered by the otherwise generally excellent software driver's inexplicable lack of hue/saturation controls.

MAG's outstanding software bundle includes Inset Technologies' ImageDock scanning/graphics suite, the effects package Kai's Power GOO SE, and a panoramic image-stitching program. The bundle also includes several wizardlike utilities that make it easy to scan and assemble images into greeting cards, calendars, and other documents. The OCR package, Caere's OmniPage LE, fared well on our informal OCR test.

Families will appreciate the DTS-3060's low price, attractive output, and unique, kid-friendly interface.—DL

Memtek Memorex SCF-9650P 3D

Letter-size; 300 x 600; 30-bit; parallel-port; \$90 street. Santa Fe Springs, CA; 800-636-8352; www.memorex.com; 509 at www.pcmag.com/infolink.

● The inexpensive Memorex SCF-9650P 3D is marketed to home and business



users who want a general-purpose scanner that can scan three-dimensional objects placed on its bed. While the Memorex's depth of field allows users to scan objects up to 2.5 inches in height, it's a slow performer with a frustrating interface, and its image quality is subpar.

The Memorex is unique in its ability to scan small 3-D objects rather than just flat documents; the oversize copyboard is hinged so it can be raised several inches. Such scans are of just so-so quality, however. Sharpness is uneven, and the scanner's variable illumination can make the sides of objects unacceptably dark. Colors are dark and muddy and shadow details are indistinct. In addition, the 3-D scan function is quite slow, taking over 4 minutes to complete a 300-dpi scan.

Traditional 2-D scans are also disappointing. Colors are muddy, and details are lost in the highlights. The Memorex placed 22nd (out of 25) for both plain- and photo-paper output. The Twain interface appears simple to use at first glance, but it's actually difficult to adjust the settings to improve image quality, in part because the prescan image preview may appear significantly different from what the scanned image looks like on a computer monitor or as a hard-copy print.

There's also a paucity of image-correcting prescan tools. Worse yet, we found that the scanner often produced different images at identical settings, including the defaults. The Memorex had one important driver bug that we discovered while testing: It will invert images into the negative when scanning a gray scale if the computer's BIOS is set to ECP instead of

EPP parallel. Memorex plans to fix the problem soon.

Sluggish performance and mediocre image quality make this unit tough to recommend, unless you need to scan small objects, not just photos and documents.—DG

and SWG

Microtek SlimScan C3, ScanMaker E3 Plus PC SCSI, ScanMaker 4

SlimScan C3: Letter-size; 300 x 600; 36-bit; parallel-port; \$100 street. **ScanMaker E3 Plus PC SCSI:** Legal-size; 300 x 600; 30-bit; SCSI; \$150. **ScanMaker 4:** Legal-size; 600 x 1,200; 36-bit; SCSI; \$700. Redondo Beach, CA; 800-654-4160, 310-297-5000; www.microtekusa.com; 510 at www.pcmag.com/infolink.

● These Microtek scanners run the gamut from a lightweight CIS unit to a heavy-duty model for graphics pros. All three have an easy-to-use driver filled with sophisticated features. Two of these (the Microtek ScanMaker E3 Plus PC SCSI and the ScanMaker 4) have better-than-average image quality; the entry-level Microtek SlimScan C3, however, is disappointing.

The powerful ScanWizard driver, which is essentially identical on all three Microtek units, is one of these scanners' strengths. It lets you adjust settings such as contrast, brightness, saturation, hue, and levels of red, green, and blue. Experienced users will appreciate advanced settings like black point, white point, mid-point, and gamma, and the driver shows the effects of each change as you make it. Even better, the controls are easy to get, but they're not placed on the main screen so as to avoid overwhelming novice users.

The compact SlimScan (just 1.7 by 10.4 by 16.4 inches and 7.7 pounds) uses the new CIS technology and is designed for home and small-office users. As with other CIS scanners, image quality was acceptable for casual users but a step below that of a typical CCD-based unit. Skin tones showed a loss of tonal variation, and a lack of fine detail led to a soft-focus effect. Our jury ranked the SlimScan's output near the bottom of our test group. Resolution and Uniformity scores were also below average; in its favor, the unit showed almost no color registration error.

Using the SlimScan was a bit of a problem. Since the SlimScan has a CIS instead of a CCD, it's so lightweight—and its



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Planes that cost millions of dollars have "mechanical

failure." Two airport hotdogs is too many. I played 18 holes

between spreadsheets. I wonder where they're all

going? When you say it over and over again, "delay" starts

to sound funny. Lying down would be good. Three dollars



"FOR STANDING UP TO THE VAGARIES OF TRAVEL, THE MICRON GOBOOK IS THE BEST BET GOING."

CNET "EDITORS' CHOICE" BEST ULTRAPORTABLE REVIEWED, 5/98

GOBOOK²



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ou don't get to recharge your batteries every four hours. You don't get to rest whenever you feel like it. Why should your notebook? Life on the road is no cakewalk and your notebook should be designed to endure the rigors of mobile life as well as you do. Introducing the GoBook notebook. With a revolutionary modular battery design, lightning-fast performance featuring the fastest Intel® Pentium® II processors, and an incredibly thin and light package, it's the ultimate companion for those who stop at nothing to succeed. It's no wonder that CNET just awarded the GoBook Editors' Choice for best UltraPortable on the market, saying, "Micron's GoBook lessens the angst of life on the road."

lot for water. Solitaire is actually
pretty fun for about a minute.

That person looks like somebody I
know. I'm actually excited about

the prospect of getting on a plane.
Why isn't my cell phone working?

That kid keeps staring at my
GoBook. This is better than being

in the office. I guess. What's
that smell?



YOUR ONLY FRIEND DURING A THREE-HOUR LAYOVER



10
VOL. 6 SEC. 01
98 10

"It's just enough to be happy. The question is, when do we say 'I'm done'?"

"I'm just kidding."

"The GoBook outperformed every other machine in our review by
a sizable margin" *CNET*, Editors' Choice, Best UltraPortable Reviewed, May '98



Here's the GoBook difference: Featuring the fastest Intel Pentium and Pentium II processors •

Preloaded with Microsoft's Windows 98 • Includes a big active matrix 12.1" SVGA display

powered by 128-bit graphics accelerator • A revolutionary modular battery design that performs

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drive and a 3.5" floppy drive • All in a super thin and light package that starts at just 1.35" thin and 4.4lbs.*



Model Name

GoBook™ 266 Lite

GoBook² 233

New!
GoBook² 300

Processor Intel® Pentium® processor with MMX™ technology 266MHz
Cache 512KB L2 pipeline burst cache
RAM 32MB EDO RAM
Hard Drive 3.2GB hard drive
Monitor 12.1" SVGA display
CD-ROM 24X modular CD-ROM drive
Graphics 2MB/128-bit graphics accelerator
Sound System 16-bit stereo/Wavetable sound
Warranty 5-year/1-year Micron limited warranty

Processor Intel Pentium II processor 233MHz
Cache 512KB L2 pipeline burst cache
RAM 64MB EDO RAM
Hard Drive 3.2GB hard drive
Monitor 12.1" SVGA display
CD-ROM 24X modular CD-ROM drive
Graphics 2MB/128-bit graphics accelerator
Sound System 16-bit stereo/Wavetable sound
Warranty 5-year/1-year Micron limited warranty

Processor Intel Pentium II processor 300MHz
Cache 512KB L2 pipeline burst cache
RAM 64MB EDO RAM
Hard Drive 3.2GB hard drive
Monitor 12.1" SVGA display
CD-ROM 24X modular CD-ROM drive
Graphics 2MB/128-bit graphics accelerator
Sound System 16-bit stereo/Wavetable sound
Warranty 5-year/1-year Micron limited warranty

Software Included Norton AntiVirus
System Wizard Mobile Client™™™
Microsoft® Windows® 98

Software Included Norton AntiVirus
System Wizard Mobile Client™™™
Microsoft Windows 98
Microsoft Office Small Business Edition

Software Included Norton AntiVirus
System Wizard Mobile Client™™™
Microsoft Windows 98
Microsoft Office Small Business Edition

Also Includes: Bay battery
4.4lbs (w/floppy drive)*
6.7lbs (w/opt./base battery & floppy)
USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports
MPEG compatible
CardBus/Zoomed Video ready
Microphone, stereo line-in/out jacks
2 Type II/1 Type III PCMCIA slots
2-way infrared port
Touchpad pointing device
Modular floppy drive
Add SuperBase Battery for \$299

Also Includes: Bay battery
4.4lbs (w/floppy drive)*
6.7lbs (w/opt./base battery & floppy)
USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports
MPEG compatible
CardBus/Zoomed Video ready
Microphone, stereo line-in/out jacks
2 Type II/1 Type III PCMCIA slots
2-way infrared port
Touchpad pointing device
Modular floppy drive
Add SuperBase Battery for \$299

Also Includes: Bay battery
4.4lbs (w/floppy drive)*
6.7lbs (w/opt./base battery & floppy)
USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports
MPEG compatible
CardBus/Zoomed Video ready
Microphone, stereo line-in/out jacks
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2-way infrared port
Touchpad pointing device
Modular floppy drive
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Price **\$2,399** \$84/mo. TechRefresh Bus. Lease, 36 mos.**
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Faster...Faster...Faster...

1 Clocks at speeds over 500MHz, the Quantix is the fastest land animal. This "big cat" hunts mainly parallel, but the average chase lasts only about 20 seconds.

2 In early September 1998, PC World Magazine ranks the Micron Millennia the #1 Power Desktop on the market calling it "the fastest of all" systems tested.

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Micron Systems:
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desktops, notebooks & servers

Favorite Feature:
Price/power ratio

Purpose:
Help maintain US security and freedom

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Tim Willits
Lead Map Designer, Id Software
Creators of Quake & Quake II



Micron Systems:
Micron Millennia 400 desktops

Favorite Feature:
400MHz - Of course

Purpose:
Test mind-bending levels of Quake II and
help create one of the coolest games ever

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DESKTOP
CUSTOMER
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A non-refundable up-front freight charge applies for participation in PowerXchange to cover cost of return packaging and processing.



Featuring Intel's Fastest Processor Ever

Just named #1 Power Desktop by the editors of PC World Magazine (Millennia 400 DVD - September '98), Micron's Millennia desktop product line continues a long tradition of industry-leading, award-winning performance. Perhaps that's why some of the most prominent power users around rely on Micron. No

matter how strenuous your demands, no matter how colossal the task, we invite you to put a Millennia® desktop to the test.

You'll be hard-pressed to find a Pentium® II processor based system as powerful and affordable as the Micron Millennia. And Micron's revolutionary new MPower™ purchase program makes Millennia ownership even easier, offering qualified users no interest or payments for six months as well as PowerXchange™ trade-in options on your current PC towards a new Millennia desktop.



3 The world types 170 words per minute. To give you some idea of how many words that is, this little blurb is only 28 words long.

4 Millennia features the Intel Pentium II processor 450MHz, the fastest chip available. Don't nibble for anything less.

THERE IS NO KNOWLEDGE THAT IS NOT POWER.

— RALPH WALDO EMERSON

10
VOL. 4 SEC. 01
98 10

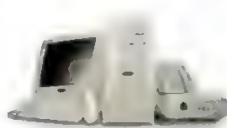
How important is a 10% performance difference? Think of it as 1 hour and 12 minutes in an 8-hour day.

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The Micron Difference: Rock-Solid Reliability. MPower™ and PowerXchange™ Programs. Industry-Leading Service and Support.

There's a lot more to owning a system than having a computer sitting on your desk. You'll always want the latest technology, the best pricing and service and

support you can count on — and that's exactly what Micron's new MPower program is all about. Call today for details or visit www.micronpc.com/pcmag.



Model Name	Millennia C300	Millennia 350	Millennia 400	New! Millennia 450	New! Millennia 450 MAX
Processor	Intel® Celeron® processor 300MHz	Intel Pentium® II processor 350MHz	Intel Pentium II processor 400MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz
Cache	128KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache	512KB internal cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.3GB Ultra ATA hard drive	8.4GB Ultra ATA hard drive	10GB Ultra ATA hard drive	10GB Ultra ATA hard drive	14.4GB 7200 RPM Ultra ATA hard drive
Monitor	15" Micron 500Vx monitor (13.8" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	DVD-ROM drive and decoder card***
Graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	Real 3D Starfighter 1740, 8MB AGP graphics
Sound System	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	64-voice WaveTable 3D stereo sound
Warranty	5-year/3-year Micron Power™ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
Software Included	Microsoft® Windows® 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition	Microsoft Windows 98 Microsoft Office 97 Small Business Edition

Also Includes:	New MicroTower™ case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Advent AV290PL-70 watt 3-piece sound system Advent subwoofer 3Com/U.S. Robotics 56K WinModem** 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive
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Upgrade to:	6.4GB Ultra ATA hard drive 17" Micron 700Vx monitor (15.9" display) 100MB Iomega Zip drive	10GB Ultra ATA hard drive 100MB Iomega Zip drive Microsoft Natural Keyboard Elite	19" Micron 900Lx (18" display) 100MB Iomega Zip drive Advent subwoofer	19" Micron 900Lx (18" display) 100MB Iomega Zip drive Advent subwoofer	100MB Iomega Zip drive 256MB 100MHz SDRAM
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— PC Magazine
June '98, '99

NetFRAME



If you're looking for the ultimate complete network solution, or simply need to upgrade your current network, consider Micron™ ClientPro® managed PCs and Micron NetFRAME® servers. Network-ready right out of the box, packing the power of the Intel® Pentium® processor 450MHz, and built on industry standards, the ClientPro effortlessly puts more manageable power in your office. And if you're looking for a reliable and expandable server, it would be tough to beat Micron's NetFRAME

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servers running with a powerful new Intel Pentium II Xeon™ processor. Since 1985 Micron's line of NetFRAME servers has been providing rock-solid, tireless service, becoming one of the most highly regarded brands on the server market today. Combining advanced technology, superlative engineering and industry-leading service and support, Micron's award-winning line of NetFRAME servers continue to push the price/performance envelope and exceed user expectation.

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†TechRefresh lease prices are based on a 36-month lease and are available to business customers. Businesses can qualify for 30-day same-as-cash and individuals for 6-month same-as-cash programs. If not paid in full by end of period, finance charges will be assessed from purchase date. APR varies and is 17.99% as of 7/27/98 with a minimum finance charge of \$1.00. Term financing is available to individuals for home or business use. Power/Exchange accepts trade-in of most major computer brands. Please call for details and the latest qualified brand list. Cash rebates are based on the average wholesale value of your PC per the Orion Blue Book or other source chosen by Micron, adjusted for condition at trade-in.

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OBSOLESCENCE PROTECTION

3. Other computer companies make you wait 2 to 4 years in their upgrade programs before you can trade up, and many hold you to restrictive finance agreements. With Micron you're eligible to upgrade a system anytime from 12 to 48 months after purchase, regardless of how you finance your purchase. Plus, you can send us your old machines for wholesale trade-in rebates which apply towards the purchase of new machines.

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4. Some manufacturers force you to purchase pre-selected software packages to qualify for their programs. Not Micron. We offer unparalleled hardware and software flexibility with all our custom-configured machines.

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Intel® Celeron™ processor 300MHz
128KB Internal L2 secondary cache
64MB SDRAM
3.2GB Ultra ATA hard drive
17" Micron 700Vx (15.9" display)
32X max speed CD-ROM drive
Integrated vMedia like 128, 4MB SGRAM 3D AGP graphics
64-voice PCI Wavetable sound
3Com 3C905 WOL 10/100 network card
5-year/3-year Micron Power™ limited warranty
Intel LANDesk® Client Manager available
Microsoft® Windows NT® Workstation 4.0®
Norton AntiVirus
SMART II hard drive monitoring
Chassis intrusion detection
Fan, temperature, and voltage problem reporting
Virus detection reporting
Remote Wake Up capability
New MicroTower case
3.5" floppy drive
104-key enhanced keyboard
Microsoft IntelliMouse®

\$1,649 ^{\$58/mo.}
TechRefresh Bus.
Lease, 36 mos.™



New! ClientPro CS 450

Intel Pentium II processor 450MHz
512KB Internal L2 secondary cache
128MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700Vx (15.9" display)
32X max speed CD-ROM drive
Diamond Viper 330 nVidia, 4MB AGP video
64-voice PCI Wavetable sound
3Com 3C905 WOL 10/100 network card
5-year/3-year Micron Power™ limited warranty
Intel LANDesk Client Manager available
Microsoft Windows NT Workstation 4.0®
Norton AntiVirus
SMART II hard drive monitoring
Chassis intrusion detection
Fan, temperature, and voltage problem reporting
Virus detection reporting
Remote Wake Up capability
MiniTower case
3.5" floppy drive
104-key enhanced keyboard
Microsoft IntelliMouse

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NetFRAME 3100 Small Business Server Edition

Intel Pentium II processor 350MHz
512KB Integrated L2 ECC cache
64MB ECC 100MHz SDRAM
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32X max speed CD-ROM drive
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Dedicated server technical support, 7x24
1-year next-business-day on-site service
Intel LANDesk Server Manager 2.8
Microsoft BackOffice Small Business Server 4.0
(10-user license)
Intel 440BX chip set
100MHz front side bus
Integrated Symbios PCI Ultra Wide SCSI-3
dual channel controller
Intel EtherExpress Pro 100 network adapter
5 expansion slots: 3PCI, 1ISA, 1 shared PCI/ISA
8 drive bays: 1 external 3.5", 2 external 5.25"
5 hot-swap 1.0" hard drive bays
Integrated SVGA graphics 2MB
Microsoft mouse, 104-key enhanced
PS/2 keyboard
3.5" floppy drive

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New! NetFRAME 6200

Intel Pentium II Xeon™ processor 400MHz
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128MB ECC EDO DRAM
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32X SCSI CD-ROM drive
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Microsoft Windows NT Server 4.0 (10-user license)
Supports up to four Intel Pentium II Xeon processors
Options for 512KB or 1MB L2 cache Xeon processor
Intel 450NX chip set
Memory: ECC EDO up to 4GB (via 16 DIMM sockets)
7 expansion slots: 6 PCI, 1 shared ISA/PCI
2 integrated Symbios U2W LVDS controllers
1 integrated Symbios narrow SCSI controller
Intel EtherExpress™ Pro 10/100 PCI Ethernet card
Integrated SVGA graphics
3.5" floppy drive
6 internal, hot-swappable hard drive bays
1 hot-swappable 400-watt power supply
(upgradable to three w/redundancy)
3 external 5.25" media bays
Free-standing pedestal chassis standard
(rack mount option available)
Emergency Management Port
ICMB and cluster support
104-key Enhanced PS/2 keyboard
Microsoft mouse
1 parallel, 2 serial ports

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Micron was also the first direct PC company to ship Microsoft Windows NT over four years ago and is one of the leaders in the current shift to the Windows NT platform. So when you're ready to put the power of Windows NT management into your office network, look to the experience and affordability of Micron ClientPro managed PC and Micron NetFRAME servers. Call today for more information or to order direct from the factory or visit www.micronpc.com/cshop.



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Desktop Scanners

footing so slippery—that we had trouble picking up the lid without moving the scanner. More troublesome, when we scanned lightweight paper (such as our test page torn from *PC Magazine*), the lid didn't hold the paper flat. Microtek is aware of these problems and is redesigning the scanner to fix them. Another problem we encountered was speed: Scanning a letter-size page in gray-scale mode at full optical resolution took more than 25 minutes.

The excellent driver design doesn't make up for the SlimScan's limitations. Even if all you want to do is scan an occasional photo for e-mailing to relatives, you can do better with the CCD-based Artec ViewStation for about the same price.

The faster, more full-featured ScanMaker E3 Plus PC SCSI is aimed at SOHO users. Also available in a parallel-port version (\$130 street), this scanner shares all of the SlimScan's good points and none of its bad ones. On-screen image quality showed rich, natural colors, along with fine detail and natural shading of skin tones. Our jury ranked the scanner's output in the top tier. The driver is essentially identical to the SlimScan's. On the whole, the ScanMaker E3 Plus PC SCSI offers good image quality at a relatively low cost, and it should be on your short list.

Microtek's top-of-the-line ScanMaker 4 is aimed at corporate communication specialists and graphic designers. Its on-

screen image quality offers good tonal variation and fine detail, and our jury gave it a first-place ranking for its plain-paper output. Note, too, that by the time you read this, the ScanMaker 4 will be shipping with a more sophisticated driver offering features of particular interest to graphics professionals, such as the ability to scan to CIE-LAB and CMYK color spaces.

We did encounter a potentially troubling issue with the ScanMaker 4—namely, dust. The unit has a slide-out tray for loading transparencies, a design it shares with the AGFA DuoScan T1200. Though the tray conveniently lets you scan transparencies without a separate adapter, it presents a large opening for dust to get under the platen. Microtek points out that

SUMMARY OF FEATURES

Desktop Scanners

PC MAGAZINE
EDITORS' CHOICE

■ YES ■ NO

Products listed in review order.

	Adara MegaStar I	AGFA DuoScan T1200	Artec ViewStation AM12E	Canon CanoScan FB 320P	Canon CanoScan 600	Epson Expression 636 Artist 2
Price	\$750 street	\$699 list	\$85 street	\$80 street	\$300 street	\$700 street
Engine manufacturer/Type of sensor	Microtek/CCD	AGFA/CCD	Ultima/CCD	Canon/CIS	Canon/CCD	Epson/CCD
Rated maximum scan area, in inches	12.0 x 17.0 (tabloid)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)
Maximum color depth of scans	36-bit	36-bit	30-bit	30-bit	30-bit	36-bit
Color depth passed to applications	36-bit	36-bit	24-bit	24-bit	24-bit	24-bit
Scan in 8-bit color	■	■	■	■	■	■
True optical resolution (dpi)	400 x 800	600 x 1,200	600 x 1,200	300 x 300	600 x 1,200	600 x 600
Number of gray levels	256	4,096	1,024	256	256	256
Interface connection	SCSI	SCSI	Parallel port	Parallel port	SCSI	SCSI
List price of transparency adapter	N/A	N/A	\$99	N/A	\$429	\$599
Capacity of ADF (list price)	N/A	10 pages (\$249)	100 pages (\$150)	N/A	30 pages (\$279)	50 pages (\$499)
User can remove glass to clean dust	■	■	■	■	■	■
Image-editing software included	Color It!, iPhotoExpress, iPhoto Plus	Corel Photo-Paint 8	ixia Artist	Adobe PhotoDeluxe 2.0	Adobe PhotoDeluxe 2.0	Adobe Photoshop LE, Painter 5.0, SilverFast
OCR software included	OmniPage LE	OmniPage LE	TextBridge Classic	TextBridge Plus	TextBridge Plus	TextBridge Classic
Other software included	Adobe Acrobat Reader, PaperMaster	Adobe Acrobat Reader, FotoLook	ixia Photo Scanner Suite, Microsoft Internet Explorer	None	None	None
Twain driver included	AdaraScan	AGFA FotoLook	Fastimator	ScanCraft CS, ScanGear CD 6.0P	ScanCraft CS	Epson Scanning Utilities Twain
Zoom (number of levels)	■ (7)	■ (infinite)	■ (2)	■ (6)	■ (6)	■ (infinite)
Batch scanning/Rotate	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Blur filter/Sharpen filter	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Edge-enhancement filter	■	■	■	■	■	■
Other major image controls	Emboss, unsharpen	Variety	Invert, mirror	Variety	Variety	Color correction, negative scanning
Closed-loop calibration	■	■	■	■	■	■
Presets for particular printers	None	None	Canon, HP	None	None	Epson, others
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	1 year
Toll-free technical support	■	■	■	■	■	■
Technical-support hours (eastern time)	Noon–9:00 P.M. M–F	8:00–8:00 M–F	11:00–8:00 M–F	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days
Web site	www.adara.com	www.agfahome.com	www.artecusa.com	www.ccsi.canon.com	www.ccsi.canon.com	www.epson.com

N/A—Not applicable: The product does not have this feature.

you can take off the glass to clean the underside, but this isn't mentioned in the manual, and it's a bit of a chore in any case.

Ultimately, what matters most to the target audience is image quality, and here the scanner faces stiff competition from the Epson Expression 636 Artist 2. We prefer the Expression by a narrow margin, but the Microtek ScanMaker 4 should also be on your radar.—MDS

Mustek Plug-n-Scan 1200 A3 EP, Paragon PowerPro

Plug-n-Scan 1200 A3 EP: Tabloid-size; 300 x 600; 36-bit; parallel-port; \$220 street. **Paragon PowerPro:** Letter-size; 1,200 x 4,800; 36-bit; SCSI; \$750 street. Irvine, CA; 800-468-7835, 714-790-3600; www.mustek.com; 511 at www.pcmag.com/infolink.

● The Mustek Plug-n-Scan 1200 A3 EP is a low-cost CIS scanner for budget-conscious users who need to scan tabloid-size media. As with other CIS units, image quality was disappointing. The Paragon PowerPro is a solid choice for high-resolution graphics work, though we found better image quality at this price level from the Epson Expression and Microtek ScanMaker 4.

As the lowest-priced tabloid-size flatbed on the market, the Plug-n-Scan may appeal to home and business users who frequently scan oversized originals such as newspapers and newsletters. Installing the scanner was simple. Because of its tabloid-size scanbed, the Plug-n-Scan has a large footprint that makes it very stable. On the other hand, being a

CIS scanner, it's light and has a very low profile and is designed so that the scanner can be stood upright on its end and still function. This is also one of the quietest parallel-port scanners we've encountered.

The Plug-n-Scan is not an exceptional performer, however. Its plain-paper output placed dead last on our jury ranks. In our labs, test images were dark and the colors almost posterized. We did tweak the settings with Mustek's Color Match and Color Balance options, but this only increased the contrast, intensified the colors, and created heightened posterization. Finally, we manually applied several of the interface's limited tools to tweak the image and were able to improve quality. At this point, colors were fairly accurate if not vibrant, and we

See www.pcmag.com for interactive views

Continues

PC MAGAZINE
EDITORS' CHOICE

Heidelberg Jetset 2	HP ScanJet 4100C	HP ScanJet 6200C	INFO Peripherals ImageReader UltraPro	MAG Innescan DTS-3060	Memorex SCF-9650P 3D	Microtek SlimScan C3
\$500 street	\$200 street	\$400 street	\$140 street	\$150 street	\$90 street	\$100 street
UMAX/CCD	Hewlett-Packard/CCD	Hewlett-Packard/CCD	Avison/CCD	MAG/CCD	E-Lux/CCD	Microtek/CIS
8.5 x 14.0 (legal)	8.5 x 11.7 (letter)	8.5 x 14.0 (legal)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)	8.5 x 11.4 (letter)	8.5 x 11.7 (letter)
30-bit	36-bit	36-bit	30-bit	36-bit	30-bit	36-bit
30-bit	36-bit	36-bit	24-bit	24-bit	24-bit	24-bit
■	■	■	■	■	■	■
600 x 1,200	300 x 600	600 x 1,200	600 x 1,200	600 x 1,200	300 x 600	300 x 600
256	256	256	256	256	1,024	256
SCSI	USB	SCSI, USB	Parallel port	Parallel port	Parallel port	Parallel port, USB
\$175	N/A	N/A	N/A	N/A	\$65	N/A
N/A	N/A	25 pages (included)	N/A	N/A	N/A	N/A
■	■	■	■	■	■	■
Color Factory Pro, Picture Publisher	Adobe PhotoDeluxe	Adobe PhotoDeluxe	PictureFun!	PhotoImpact	MGI Photoshop LE	PhotoImpact 4.0
TextBridge Classic	OmniPage LE	OmniPage LE	OmniPage LE	OmniPage LE	TextBridge Lite	OmniPage LE
Font Explorer	HP ScanJet Copy Utility	HP PrecisionScan LAN software, HP ScanJet Copy, PageKeeper	InfoCenter 32, PictureFun, three-button scan, voice mail annotation, voice recognition	Kai's Power G00	BizCard, Image Folio, Image Type, PhotoAlbum, Presto! OCR 3.0, Presto! PageManager, PrintMagic	Kai's Photo Soap, PaperMaster SEC
Color Factory Pro, Twain Host	None	None	None	DTS-3060	Avison 3.10	Microtek ScanSuite, ScanWizard
■ (infinite)	N/A	N/A	N/A	■ (infinite)	■ (12)	■ (infinite)
■ ■	N/A	N/A	N/A	■ ■	■ ■	■ ■
■ ■	N/A	N/A	N/A	■ ■	■ ■	■ ■
■ ■	N/A	N/A	N/A	■ ■	■ ■	■ ■
Color correction, fine field, sector	HP Intelligent Scanning Technology	HP Intelligent Scanning Technology	None	Deskew, despectle, flip, invert	Color balance, scale	Aspect-ratio lock, emboss, smoked-glass effect, unsharpen
■	■	■	■	■	■	■
Canon, Epson, HP, NEC	None	None	None	None	Epson, HP	Canon, Epson, HP, others
1 year	1 year	1 year	2 years	3 years	1 year	1 year
■	■	■	■	■	■	■
9:00-8:00 M-F	8:00 A.M.-midnight M-F, 11:00-6:00 Sat.	8:00 A.M.-midnight M-F, 11:00-6:00 Sat.	11:00-6:00 M-F	8:00-8:00 M-F	10:00-7:00 M-F	10:00-6:00 M-F
www.linocolor.com	www.scanjet.com	www.scanjet.com	www.infoconnection.com	www.maginnovision.com	www.memorex.com	www.microtekusa.com

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Desktop Scanners

could clearly discern detail in shadow areas. Also, although scans appeared sharp in places, the sharpness was rarely consistent across the entire image.

Bundled software includes full versions of Picture Publisher 5.0 and 6.0, an early version of Adobe Acrobat, full versions of iPhoto Plus 1.2 and iPhoto Plus 4.0a, and Xerox's TextBridge Classic OCR software. Though we like the price and tabloid capability, it's still tough to recommend this unit.

The Mustek Paragon PowerPro is a well-constructed, large, and relatively heavy scanner built for high performance. It comes with a profile customized to fit the specific scanner, which can be used for precise color calibration with printers and

monitors. Setup and installation was straightforward and trouble-free, aided by a test button in the installation interface that lets you confirm your settings. One caveat: While the interface gives the user extensive control and informative feedback over scanning parameters, there's no contrast control, and the preview window cannot be enlarged.

The graphics-oriented PowerPro features exceptionally high optical resolution, which rivals that of high-end professional scanners costing many thousands of dollars. It may prove useful for scanning and scaling small-sized originals destined for larger printouts. In our labs, the PowerPro produced scans that were clean, crisp, and well exposed. We were able to distinguish

details clearly in both shadow and highlights. Although the skin tones were fairly accurate, we noticed that other colors tended to drift towards the lighter end of the spectrum. The PowerPro placed in the top ten with our jury when we printed output on glossy paper, and eleventh overall on plain paper—behind competing units from Epson, HP, and Microtek. Where it excelled was on our Resolution test, running straight off the charts, since the scanner has greater resolving power than our resolution test target.

Bundled software includes a full version of Picture Publisher and a lite version of Pagis that includes Xerox's TextBridge. We would have expected full versions with a scanner of this price and performance.

SUMMARY OF FEATURES

Desktop Scanners

	Microtek ScanMaker E3 Plus PC SCSI	Microtek ScanMaker 4	Mustek Plug-n-Scan A3 EP	Mustek Paragon PowerPro	Pacific Image ScanAce 1236p	Plustek OpticPro 9636P+	Plustek OpticPro 9636T
■ YES ■ NO							
Products listed in review order.							
Price	\$150 street	\$700 street	\$220 street	\$750 street	\$130 street	\$130 street	\$150 street
Engine manufacturer/Type of sensor	Microtek/CCD	Microtek/CCD	Mustek/CIS	Mustek/CCD	Pacific Image/CCD	Plustek USA/CCD	Plustek USA/CCD
Rated maximum scan area, in inches	8.5 x 13.5 (legal)	8.5 x 14.0 (legal)	11.7 x 17.0 (tabloid)	8.5 x 11.7 (letter)	8.5 x 12.0 (letter)	8.5 x 11.7 (letter)	8.5 x 11.7 (letter)
Maximum color depth of scans	30-bit	36-bit	36-bit	36-bit	36-bit	36-bit	36-bit
Color depth passed to applications	24-bit	36-bit	24-bit	36-bit	36-bit	36-bit	36-bit
Scan in 8-bit color	■	■	■	■	■	■	■
True optical resolution (dpi)	300 x 600	600 x 1,200	300 x 600	1,200 x 4,800	600 x 1,200	600 x 1,200	600 x 1,200
Number of gray levels	256	4,096	256	256	4,096	1,024	1,024
Interface connection	SCSI	SCSI	Parallel port	SCSI	Parallel port	Parallel port	Parallel port
List price of transparency adapter	\$299	Included	Info not available	\$205	N/A	N/A	N/A
Capacity of ADF (list price)	10 pages (\$400)	N/A	N/A	N/A	N/A	N/A	N/A
User can remove glass to clean dust	■	■	■	■	■	■	■
Image-editing software included	iPhotoExpress	Adobe Photoshop LE, Painter 5.0	iPhoto Plus, Picture Publisher	Color It!, iPhoto Plus 4, Picture Publisher	Prestol ImageFolio	Picture Publisher	Adobe PhotoDeluxe, Picture Publisher
OCR software included	OmniPage LE	OmniPage LE	TextBridge Classic	TextBridge Classic	Prestol PageManager, Wordlinx	TextBridge Classic	TextBridge Classic
Other software included	Kai's Photo Soap, PaperMaster SEC	None	None	None	BizCard, PageType, PhotoAlbum, Prestol PageFiler	ActionManager 32, CreateCard, fax/scan/copy utility	ActionManager 32, fax/scan/copy utility
Twain driver included	Microtek ScanWizard	Microtek ScanWizard	Mustek	Mustek	CyberView	Plustek Twain 32	Plustek Twain 32
Zoom (number of levels)	■ (infinite)	■ (infinite)	■ (2)	■ (2)	■ (2)	■ (infinite)	■ (infinite)
Batch scanning/Rotate	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Blur filter/Sharpen filter	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Edge-enhancement filter	■	■	■	■	■	■	■
Other major image controls	Aspect-ratio lock, emboss, smoked-glass effect, unsharpen	Aspect-ratio lock, emboss, smoked-glass effect, unsharpen	Emboss, reverse image, scale	Emboss, reverse image, scale	Color, exposure, halftone, highlight/shadow, tone	invert, flip, per-pixel color alignment	invert, flip, per-pixel color alignment
Closed-loop calibration	■	■	■	■	■	■	■
Presets for particular printers	Canon, Epson, HP, others	Canon, Epson, HP, others	None	None	None	None	None
Warranty (parts and labor)	1 year	1 year	1 year	2 years	2 years	1 year	1 year
Toll-free technical support	■	■	■	■	■	■	■
Technical-support hours (eastern time)	10:00-8:00 M-F	10:00-8:00 M-F	9:00-8:00 M-F, 11:00-8:00 Sat.	9:00-8:00 M-F, 11:00-8:00 Sat.	12:30-8:30 P.M. M-F	11:00-10:00 M-F	11:00-10:00 M-F
Web site	www.microtekusa.com	www.microtekusa.com	www.mustek.com	www.mustek.com	www.scanace.com	www.plustekusa.com	www.plustekusa.com

N/A—Not applicable: The product does not have this feature.

HARDWARE

Desktop Scanners

On the whole, the PowerPro is a fine graphics workhorse, especially for users who truly need high-resolution capabilities for scaling up originals.—*DG and SWG*

Pacific Image ScanAce 1236p

Letter-size; 600 x 1,200; 36-bit; parallel-port; \$130 street.
Torrance, CA; 800-909-9996, 310-618-8100;
www.scanace.com; 512 at www.pcmag.com/infolink.

● The attractively priced Pacific Image ScanAce 1236p delivers an ample set of scanning options and good image quality for buyers on a budget. It will prove welcome in many homes and offices.

Tonal shading on our test scans was respectable despite a hint of lightness in shadowed areas. Skin tones were almost true to the original photo, and transitions

between adjacent tones in the background were noticeably smooth. Bright-to-mid-toned areas were well rendered. Colors were not as vivid as the original when we used the default settings, but a little tweaking of the CyberView driver's extensive controls fixed this problem. These controls include basic gamma as well as RGB and CMY adjustments, highlights and shadow points, gamma curves over histograms (which you can save), and controls to scale, zoom, and select multiple areas.

Our jury ranked the output on plain paper a respectable seventh in this roundup. Objective-test results were mixed. The ScanAce performed very well on our Resolution and Color Registration tests but worse than average on the Ghost test.

We were particularly impressed with the ScanAce's ability to scan multiple areas of text and pictures in one pass, converting photos to halftone images while performing OCR on text. The Wordlinx OCR engine was outstanding on our informal tests, preserving the position, size, and formatting of text and converting text boxes automatically into Microsoft Word. All of these features are well documented in the detailed manuals, as well as in the easy-to-understand slide show presentations that come on the setup CD. The CD contains a quick tour program that shows how to install the scanner and gives you the option of installing the bundled software during the presentation. The bundle includes PageType form-scanning software and BizCard business card-scanning software.

The well-stocked Pacific Image ScanAce 1236p is a smooth performer that provides an excellent value for home and home-office users.—*DT*

See www.pcmag.com for interactive views

Ends

PC MAGAZINE
EDITORS' CHOICE

Sceptre S1200 Ultra High Performance Scanner

\$130 street
Kinpo/CCD
8.5 x 11.7 (letter)
30-bit
24-bit
■
600 x 1,200
256
SCSI
N/A
N/A
■
IMS Shell
TextBridge Classic
IMS Enhancer, IMS Shell, IMS Show
VividScan I
■ (infinite)
■ ■
■ ■
■ ■
■ ■
Hue, highlight/shadow, saturation, scale
■
Canon, Epson, HP, others
1 year
■
12:30-8:30 P.M. M-F
www.sceptre.com

UMAX Astra 610P

\$80 street
UMAX/CCD
8.5 x 11.7 (letter)
30-bit
30-bit
■
300 x 600
256
Parallel port
N/A
N/A
■
Adobe PhotoDeluxe
OmniPage LE
Kai's Power Goo SE, Presto! PageManager, UMAX Copy Utility
VistaScan 2.40
■ (7)
■ ■
■ ■
■ ■
■ ■
Invert, reverse image
■
Canon, HP, Lexmark, others
1 year
■
8:00-11:00 M-F, 11:00-8:00 Sat.
www.umax.com

UMAX Astra 1200S

\$180 street
UMAX/CCD
8.5 x 14.0 (letter)
30-bit
30-bit
■
600 x 1,200
256
SCSI
\$199
N/A
■
Adobe PhotoDeluxe
OmniPage LE
Presto! PageManager, UMAX Copy Utility
VistaScan 2.43
■ (7)
■ ■
■ ■
■ ■
■ ■
Invert, reverse image
■
Canon, HP, Lexmark, others
1 year
■
8:00-11:00 M-F, 11:00-8:00 Sat.
www.umax.com

UMAX Astra 1220U

\$180 street
UMAX/CCD
8.5 x 11.7 (letter)
36-bit
36-bit
■
600 x 1,200
256
USB
\$179
N/A
■
Adobe PhotoDeluxe
OmniPage LE
Presto! PageManager, UMAX Copy Utility
VistaScan 3.0
■ (7)
■ ■
■ ■
■ ■
■ ■
Invert, reverse image
■
Canon, HP, Lexmark, others
1 year
■
8:00-11:00 M-F, 11:00-8:00 Sat.
www.umax.com

Visioneer PaperPort OneTouch

\$170 street
Avision/CCD
8.5 x 11.7 (letter)
36-bit
24-bit
■
600 x 1,200
256
Parallel port
N/A
N/A
■
PhotoEnhancer
Visioneer OCR
PaperPort 5.3, Visioneer WebPublisher, AOL WebPublisher
Visioneer
■
■ ■
■ ■
■ ■
■ ■
Auto-crop
■
None
1 year
■
9:00-8:00 M-F
www.visioneer.com

Plustek OpticPro 9636P+, 9636T

OpticPro 9636P+: Letter-size; 600 x 1,200; 36-bit; parallel-port; \$130 street. **OpticPro 9636T**: Letter-size; 600 x 1,200; 36-bit; parallel-port; \$150 street. San Jose, CA; 800-685-8088, 408-453-5600; www.plustekusa.com; 513 at www.pcmag.com/infolink.

● Plustek's inexpensive OpticPro scanners share a common scan engine and have nearly the same user interface. The Plustek OpticPro 9636P+ is designed for family and SOHO users; the Plustek OpticPro 9636T, for business and corporate users who scan multiple types of media. Both are easy to use but suffer from inconsistent and sometimes problematic scan quality.

Setting up both units was uneventful, allowing us to begin scanning in minutes. The Twain interface offers basic prescan tools designed for the novice, though most users will probably prefer Action Manager 32—a destination-oriented, point-and-scan interface. The electronic documentation (in Microsoft Word format) is comprehensive and easy to follow.

The scan engine common to both units offers two features more often found in high-end devices. First, it uses *pixel-by-pixel* technology, which simultaneously processes all three color channels, rather than the *line-by-line* approach, which processes colors separately. Second, both models can scan and save in 36-bit color.

Desktop Scanners

While the pixel-by-pixel technology virtually eliminated color aliasing on our printed test sheet, its "one size fits all" descreening utility failed to eliminate the telltale herringbone patterning caused by scanning offset-printed material.

Like many parallel-port scanners, the 9636P+ has a limited memory buffer (128K) that forces most operations to halt in midstream to dump each scan line to the PC's memory. Starting and stopping like this not only slows the scanning process but creates visible banding. According to PlusTek, however, this scanner will have a 512K buffer, large enough for a continuous scan, when it reaches store shelves.

Despite the meager buffer, our test unit produced clean, artifact-free scans, though images were universally soft in focus. In addition, when using the default settings, highlights tended to be washed out and the midrange lightened. Except for skin tones, which had a pasty look, colors were generally accurate though flat and without sparkle. Our jurors had a mixed reaction, placing the scanner's photo-paper output first but ranking its plain-paper results 13th out of 25. The scanner did not do particularly well on our Resolution test until we manually toned down the brightness. On our informal OCR test, the 9636P+ was one of the best performers, with only five mistakes from its TextBridge Classic software. Bundled software includes the full version of Picture Publisher 7.0 and CreaCard.

Moving up a rung to the business-oriented 9636T, we saw scan quality that was only slightly better than that of the 9636P+. Images were as soft and indistinct as the 9636P+'s, but the default scan here was darker and muddier. Our jury ranked it third on glossy paper and 17th on plain paper. We observed some clipping in both shadows and highlights. Except for a very slight yellow overcast and a sallowness to the skin tones, colors were acceptable.

For only \$20 more than the 9636P+, the 9636T includes the ability to scan slides and negatives as well as reflective originals. Simply snap the special mask onto the glass copyboard, enter the user interface, select either negatives or transparency originals, and scan. This feature automatically downsizes the scan area (which can be further defined with the crop tool) as well as the scan itself. Although the 9636T's limited resolution prevents high-quality scaling of



up to letter-sized output from a 35-mm slide, it works well for images destined for Web pages or small prints. The 9636T's software bundle includes PhotoDeluxe 2.0, the full version of Picture Publisher 7.0, and Xerox's TextBridge Classic.

On the whole, these PlusTek scanners are acceptable if uninspiring choices. The 9636P+ is a run-of-the-mill parallel-port scanner that provides home users with most of what they'll expect, but the 9636T's built-in transparency head gives it a leg up on the competition for those who also need a quick, inexpensive way to scan film.—*DG and SWG*

Sceptre S1200 Ultra High Performance Scanner

Letter-size; 600 x 1,200; 30-bit; SCSI; \$130 street. City of Industry, CA; 800-788-2878, 626-369-3698; www.sceptre.com; 514 at www.pcmag.com/infolink.

● The latest offering from Sceptre Technologies is an unexceptional scanner that offers passable output quality and an acceptable feature set. We think you'd do better with the similarly priced units from INFO Peripherals, MAG, or Pacific Image.

Installing the Sceptre S1200 Ultra High Performance Scanner's Twain driver, application software, and 16-bit SCSI-2 board was simple and hassle-free. The software bundle is a fairly standard package that includes Xerox's TextBridge OCR engine (which performed very well on our OCR test) and GIC Technology's IMS Shell graphics/scanning suite. The IMS Enhancer image-editing module combines a Photoshop-style interface with a good selection of automated photo-retouch tools. Sceptre's Twain dri-

ver includes most of the features you'd expect in a SOHO-targeted product but lacks key functions such as descreening and auto-exposure controls. None of the components are standouts, but the bundle does come with a handy shell application that lets you use simple drag-and-drop procedures to direct output to applications such as Enhancer, Microsoft Word, Photoshop, and TextBridge.

In our labs, the scanner's default settings produced output with excessive contrast, a reddish tint, and poorly differentiated shadow details. Lowering the contrast resulted in faded colors. Indeed, we were never able to achieve top-notch output quality, though we eventually tweaked the driver enough to attain acceptable results. In our jury testing, the S1200 ranked near the bottom on both plain and glossy paper.

In its favor, the S1200 has a surprisingly utilitarian industrial chassis for the price. The drive mechanism employs a steel cable instead of the cheap plastic belt found in many scanners, and the unit's CCD is designed to remain stationary when scanning to minimize vibration and reduce the number of critical moving parts. Unfortunately, our test unit's removable cover fit poorly, and close examination revealed debris under the platen that could be cleaned only by disassembling the chassis.

All in all, it's hard to get excited about the S1200. The unit is reasonably well built and well equipped, but when it comes to image quality, there are better choices for the money.—*DL*

UMAX Astra 610P, 1200S, 1220U

Astra 610P: Letter-size; 300 x 600; 30-bit; parallel-port; \$80 street. **Astra 1200S:** Legal-size; 600 x 1,200; 30-bit; SCSI; \$180 street. **Astra 1220U:** Letter-size; 600 x 1,200; 36-bit; USB; \$170 street. Fremont, CA; 800-562-0311, 510-651-4000; www.umax.com; 515 at www.pcmag.com/infolink.

● The three models we tested from UMAX (which is currently the largest scanner vendor in the world) come with a good software bundle, excellent documentation, and an easy-to-use driver interface that features drag-and-scan simplicity. Image quality was only average on our tests, and though the UMAX 610P's parallel-port interface was easy to set up, the SCSI-based 1200S and USB-based 1220U might present problems to unsophisticated users.

The 610P is a bargain-priced, no-frills scanner marketed to home users. Setup and installation were quick and trouble-free. The cover hinge is positioned such that the copyboard can't support books and other nonflat originals. The driver interface is similar to that of UMAX's other scanners, including a one-button function that makes scanning simple. UMAX's Magic Match (actually a relabeled version of the Kodak Color Matching System) can calibrate the scanner to particular printers and monitors. The list of printers is limited, however, and the monitor adjustment relies too much on eyeballing.

At its default setting, the 610P produced slightly dark scans with oversaturated colors: Our jury ranked the scanner's output in the middle of the pack. The driver's default settings calibrate color to a generic monitor, adding too much magenta to the images. Scans were free of ghosting and artifacts, but details were lost in the highlights and midtones. Skin tones were too contrasty and unappealing. The colors were fairly accurate after some tweaking, but images were uniformly soft and lacking in detail. The 610P also scored rather low on our Resolution test. In the plus column, the 610P showed very little black noise or ghosting on our tests.

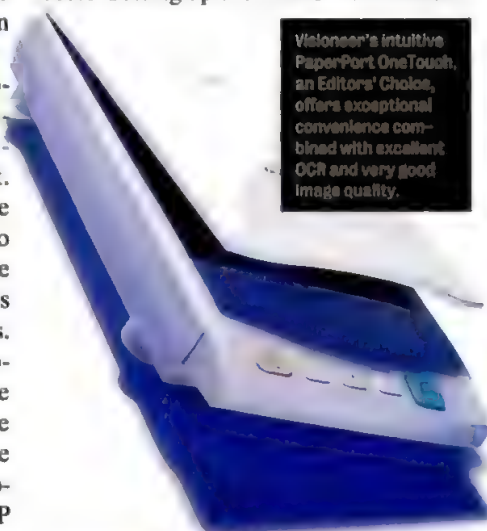
Bundled software (common to all three scanners) includes VistaScan, Adobe PhotoDeluxe 2.0, Presto! PageManager, and Caere's OmniPage LE. This scanner offers what you'd expect for such a low price: mediocre image quality, a limited driver, and novice-friendly ease of use—its saving grace.

Installing the more business-oriented 1200S proved a bit more complicated. Although the 1200S is a well-constructed scanner, it comes with a no-name 16-bit SCSI card that isn't automatically recognized by Windows 95 or 98; you must first install the drivers and then test to see if the scanner is communicating with your PC. Once set up, the scanner performed admirably. It's relatively fast and quiet. Unfortunately, we noticed considerable dirt, debris, and even tiny scratches on the underside of the scanned, which showed up as spots on our images.

In our labs, however, we found it difficult to tweak the settings for our jury test

image. The preview screen bore little if any relation to the scanned image, and at the default settings our scans were simply too bright. Boosting the contrast gave us more detail in the midtones but tended to cause clipping in the shadows. Colors and skin tones were very good, but images lacked snap. Our jury placed this scanner's images in the middle of the test range. On the whole, we preferred the similarly priced scanners from Microtek and Visioneer.

The 1220U is marketed to SOHO users. Setting up the 1220U was unneces-



sarily complicated, despite the plug-and-play promise of its USB interface. First, the instructions warned us not only to turn off both scanner and PC (which is odd, because USB is hot-swappable and does not require powering down) but to unplug the AC cords as well. Then, when installing the driver, we were asked to insert our Windows 98 master CD-ROM. Also, we found that the 1220U's innards were even dirtier than those of the 1200S, which negatively affected our scans.

Like the 1200S, the 1220U tended to scan too brightly. Scans were overly contrasty, with clipping in both the highlights and shadows. Colors were fairly good, except for a magenta cast. Our jury ranked the 1220U's output in the bottom third. Although the USB interface has the potential to make scanners much simpler to install and use, the UMAX 1220U is not quite up to standard. Simple improvements to the setup procedure and better image quality would make this an attractive option for many users.—*DG and SWG*

Visioneer PaperPort OneTouch

Letter-size; 600 x 1,200; 36-bit; parallel-port; \$170 street (after \$30 rebate). Fremont, CA; 800-787-7007, 510-608-6300; www.visioneer.com; 516 at www.pcmag.com/infolink.



For quick, customizable, effortless scanning, you can't beat the Visioneer PaperPort OneTouch, our Editors' Choice for home and home-office users. It's an excellent document scanner and very good at scanning images.

Visioneer packs a number of thoughtful, convenient features into the OneTouch, and we needed only a few minutes to set it up. The driver interface let us customize the buttons on the front of the scanner for instantaneous scanning, copying, and faxing with our desired image settings—eliminating the need to click through a maze of software menus and controls. The unit's adjustable lid enables you to scan books, magazines, and small objects.

The trade-off for this simplicity, however, is that image-tweaking options are limited. There are only a few simple pre-scan tonal controls that let you adjust under- or over-exposed originals. The driver software also lacks a zoom feature, making it difficult to select custom-sized originals for the scan area precisely. But the image can be cleaned and touched up later with the bundled PhotoEnhancer from PictureWorks. Other software includes Quicken's ExpensAble SE, which lets you scan, file, and organize your personal expenses.

Images reproduced by the OneTouch were sharp, with very few signs of softening. Tonal range was respectable, with highlighted, shadowed, and midtone areas showing up well. The scanner also accurately reproduced the challenging skin tones from our photo target. It was ranked fifth on plain paper by our jury. Most notably, Visioneer's own bundled OCR software was astounding, making only five minor errors while preserving the columns and large opening capitals in the rigorous document we scanned.

Using the Visioneer PaperPort OneTouch is so intuitive, it's comparable to a photocopier or fax machine. Though it lacks high-end image-adjustment features, the OneTouch's exceptional convenience and great OCR abilities make it a winner for home or office.—*DT PC*

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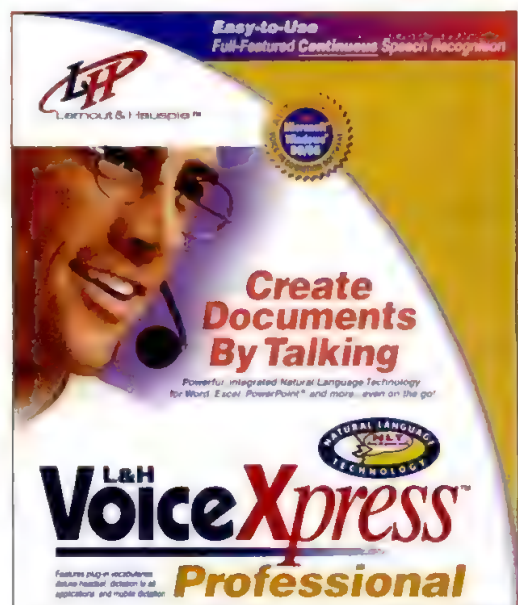
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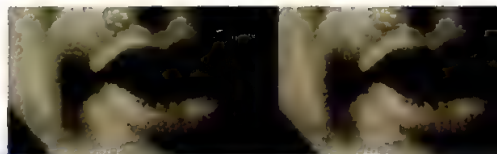
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SPEECH RECOGNITION: FINDING ITS VOICE

One year after a major technological breakthrough, continuous-speech recognition is poised to become a viable business tool.

BY GREG ALWANG



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Even in an industry in which product life cycles can be measured in months, continuous-speech recognition software remains a relatively young technology. Dragon Systems introduced the first general-purpose continuous-speech recognition program for the PC in June of last year; IBM Corp. followed soon after. In our first comprehensive look at this category ("Watch What You Say," March 10, 1998), we marveled at the potential of this new technology but contended that more work needed to be done before mainstream users would embrace it.

It didn't take long for speech vendors to respond. Since that story, Dragon and IBM have released major upgrades. Versions of NaturallySpeaking and ViaVoice have found their way into office suites from Corel and Lotus, respectively. And two other vendors, Lernout & Hauspie Speech Products and Philips Electronics, have also entered this emerging market.

To sustain this growth, speech recognition software will have to evolve quickly from last year's technological darling to

this year's productivity tool. To see how far it has come, we tested four general-purpose continuous-speech recognition programs for the PC: Dragon NaturallySpeaking 3.0 Preferred Edition, IBM ViaVoice 98 Executive, L&H Voice Xpress Plus, and Philips FreeSpeech98.

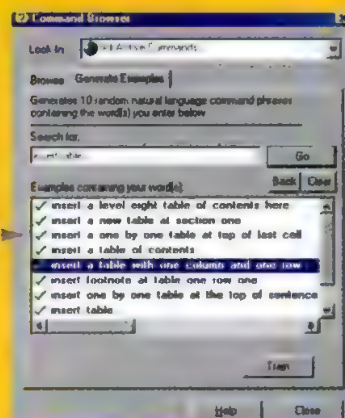
There's no doubt that speech recognition software has improved significantly in a short time. The programs we tested offer larger active vocabularies. The speech recognition engines have become savvier. And you can dictate directly into most popular applications. NaturallySpeaking, ViaVoice, and Voice Xpress all support modeless operation, so you can switch seamlessly between dictation and other tasks. These three also let you issue commands in Microsoft Word in plain English. ViaVoice takes command-and-control a step further, putting virtually every function on your PC at your beck and call.

Of the four, NaturallySpeaking consistently delivered the best accuracy. Voice Xpress makes an impressive debut with tight Microsoft Word-integration and the second-best accuracy. ViaVoice offers

Our Contributors: GREG ALWANG and CRAIG STINSON are contributing editors of *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

What to Look For in a Speech Recognition Program

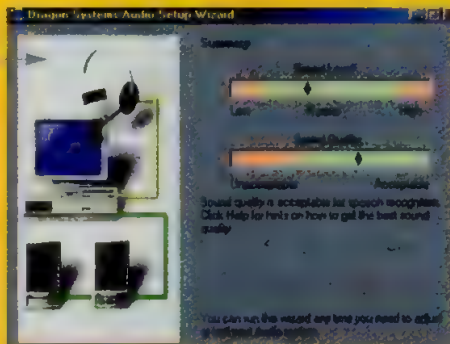
The bottom line for speech recognition software is accuracy. If the software can't decipher what you said correctly, nothing else matters. But speech recognition programs can do more than take basic dictation, and there are a lot of other features that make these packages productivity-enhancing tools.



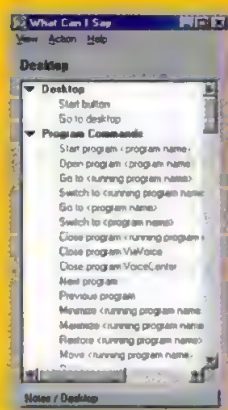
APPLICATION INTEGRATION
In the future, speech recognition will take place in the background and speech will become simply another way of using your PC. As a precursor to that, vendors have been developing tight links between their speech-recognition programs and the applications you use every day, especially word processors. Lemnate & Hauspie Speech Products has focused its efforts on integration with Microsoft Word (Microsoft is an investor in L&H). In this example, we dictated directly into Word using L&H Voice Xpress Plus. The Command Browser shows all of the variations that can be used to insert a table into Word.

SETUP AND TRAINING

The four programs we tested include wizards to get you started. In this example, we used Dragon NaturallySpeaking 3.0 Preferred Edition's New User Wizard to adjust the volume, measure sound quality, and train the program. To improve accuracy further, you can import documents containing common words.



EDITING AND FORMATTING
Getting the words onto the screen is only half the job. How well speech recognition software handles editing and formatting is also critical. In this area, the packages we tested have made major strides with modeless operation and natural-language support. We also found lots of shortcuts. For example, when NaturallySpeaking stumbles on a homonym, you can simply repeat the word and the program will select the alternative.



COMMAND-AND-CONTROL
Although continuous speech dictation is a relatively recent development, command-and-control applications have been around for years. IBM is taking the lead in this area with ViaVoice 98 Executive. ViaVoice allows you to do virtually anything with voice commands. A "What Can I Say" dialog box lists the commands that are available anywhere in Windows.

Dragon NaturallySpeaking 3.0 Preferred Edition

\$150 street, including VXI Parrott 10-3 microphone headset. Dragon Systems Inc., Newton, MA; 800-437-2468, 617-965-5200, www.dragonsys.com. 517 at www.pcmag.com/infolink.



Already in its third generation, Dragon NaturallySpeaking (\$150 street) boasts the best accuracy we've seen yet. Several new features, such as dictation into most Windows applications, integration with Microsoft Word and Corel WordPerfect, improved natural-language support, and a host of hands-free editing improvements, enhance usability. Together, these developments bring continuous-speech recognition a step closer to becoming a mainstream tool.

Our copy of NaturallySpeaking included a VXI Parrott 10-3 microphone headset that fit more comfortably than the Andrea NC-80 shipped with IBM ViaVoice 98 and L&H Voice Xpress Plus. NaturallySpeaking comes with different makes and models, however, including the NC-80, so you may find a different one in your box.

NaturallySpeaking's New User Wizard guides you through the process of creating a new speech file, configuring the microphone headset, and training NaturallySpeaking to recognize your voice. Here, you can also run the Vocabulary Builder, which imports text files. Using the Vocabulary Editor, you can add and train individual words or macros and browse through the 30,000-word active vocabulary.

After only 4 minutes of training the program and viewing the Quick Tour, we were able to dictate and edit with decent accuracy. After completing the 30-minute General Training process, which you can revisit at any time, accuracy improved greatly. NaturallySpeaking now includes BestMatch recognition technology that further enhances accuracy. But BestMatch requires a system with a 200-MHz Pentium processor or better and at least 48MB of RAM. We used BestMatch in our testing because it was installed by default.

In our tests, NaturallySpeaking was the most accurate product. On the average, it translated 91 percent of the words correctly. Most users should attain accuracy levels of 87 to 95 percent.

unparalleled command-and-control capabilities, but its accuracy was disappointing. Finally, FreeSpeech costs a lot less than the competition, but it also gives you a lot less.

During testing, we discovered a few useful tips. First, speech recognition programs are power-hungry. We recommend a 300-MHz Pentium II PC with a separate 16-bit Sound Blaster-compatible sound card (the sound cards included on PC motherboards tend to be inferior). Second, if you plan to do a lot of dictation, invest in

a better microphone. Finally, remember that, like golf, dictation takes practice.

Clearly, there's still room for improvement in these programs. Their accuracy falls a little short of our expectations, and editing and formatting documents using your voice is still too difficult. But these barriers are rapidly falling. Speech recognition is still not for everyone, but if you can benefit from dictation, you'll find that the best of these programs can boost your productivity.

Editors' Choice

• Dragon NaturallySpeaking 3.0 Preferred Edition



The three most important features of speech recognition software are: accuracy, accuracy, accuracy. Dragon NaturallySpeaking includes many innovative

features, but Dragon Systems has focused most of its efforts on developing the most accurate recognition engine. As our tests demonstrate, they've succeeded, earning NaturallySpeaking our Editors' Choice award.

NaturallySpeaking came out on top on all of our accuracy tests. Using the

BestMatch technology installed by default on our test systems, NaturallySpeaking attained an average accuracy of about 91 percent, and most users can expect to get 87 to 95 percent accuracy after completing the general training. We'd still like to see even better accuracy—at least 95 percent. But NaturallySpeaking comes closest to achieving this mark.

NaturallySpeaking sports some impressive voice-editing options and thanks to the Quick Reference Card, we were using these in no time. In addition to selecting words, sentences, lines, and paragraphs, NaturallySpeaking includes Select and Say, which lets you select a range of words by saying "select <start text> through <end text>." The "Resume With <word>" command lets you backup to a specific word and continue dictating, automatically deleting everything after that word.

In addition to Select and Say, there is an abundance of editing shortcuts. For example, you can switch between homonyms by selecting a word and repeating it. For capital letters or words, just say "cap <letter>" or "all cap <word>" while dictating. You can select a word and say "Spell That" and immediately give the proper spelling without switching modes or invoking the Correction box. All of these shortcuts add up to better throughput and easier editing. NaturallySpeaking boasted some of the best throughput

scores.

FreeSpeech98, when correcting words, NaturallySpeaking gives you a list of close matches from which you can select by voice. In correction mode, you can also train new words using voice commands.

NaturallySpeaking can play back your actual dictation or convert text to speech, but as with Voice Xpress, the synthesized voice can be difficult to understand.

NaturallySpeaking supports dictation into most Windows applications. In Word

There are many other reasons to recommend NaturallySpeaking. Its New User Wizard is thorough and easy to follow. You can dictate directly into most applications, and the program integrates with Microsoft Word and Corel WordPerfect. And it includes some useful shortcuts that streamline dictation.

NaturallySpeaking is still playing catch-up in some areas. It can't match the command-and-control capabilities of IBM ViaVoice 98 and L&H Voice Xpress Plus. And in general, we feel there's room for further improvement in this category as a whole. But when you combine NaturallySpeaking's superior accuracy with its ease of use, you get a tool with the potential to make life a little easier for many business users.

or WordPerfect, you can use natural-language commands. One of the biggest shortcomings of NaturallySpeaking, however, is that unlike ViaVoice and Voice Xpress, it doesn't allow you to control Word 97's pull-down menus.

Although ViaVoice and Voice Xpress continue to challenge NaturallySpeaking with extensive application integration and command-and-control features, Dragon NaturallySpeaking excels in the areas that count most, making it the best choice for dictation.—Greg Alwang

IBM ViaVoice 98 Executive

\$150 street including the Andrea Electronics NC-80 microphone headset. IBM Corp., West Palm Beach, Florida; 800-825-5263, 914-642-3000; www.ibm.com/viavoice. 518 at www.pcmag.com/infolink.

• The latest continuous-speech recognition offering from IBM, ViaVoice 98 includes a smarter speech recognition engine, modeless operation, and extensive command-and-control capabilities. But it falls short on accuracy.

ViaVoice features a 64,000-word base vocabulary that can be expanded to 128,000 words—the largest working vocabulary of any product in this roundup. Like L&H Voice Xpress Plus, ViaVoice ships with an Andrea NC-80 microphone headset, which was not as comfortable during testing as the VXI Parrott 10-3 microphone headset bundled with our copy of Dragon NaturallySpeaking.

ViaVoice is intelligently designed and

Dragon NaturallySpeaking

VERDICT: The original continuous speech recognition program for mainstream use is still the best. Although it lacks some of the application integration and command and control features in other programs, NaturallySpeaking is the most accurate hands-down.

	POWER	EASE
SETUP AND TRAINING	★★★★	★★★★
EDITING AND FORMATTING	★★★★	★★★★
APPLICATION INTEGRATION	★★★	★★★
COMMAND AND CONTROL	★★★★	★★★★

PERFORMANCE TESTS

AVERAGE WORD ACCURACY
91%

EXPECTED ACCURACY
87% to 95%

REVIEWER'S COMMENTS "I think Dragon thought a lot about usability and making dictation a smooth process. After a couple of days of using the product, I could just blurt out a letter."

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easy to learn. Once you complete the setup, a wizard provides a short tour, helps you configure the microphone and speakers, and walks you through the Quick Training module. To enroll, you simply read from your choice of several texts and then let the software process your voice information. The system supports multiple users and multiple enrollments per user to accommodate different vocabularies or acoustical environments or both. You can port your working vocabulary from machine to machine.

ViaVoice boasts an uncommonly intelligent recognition engine, capable of using context to distinguish nuances of spelling and capitalization. It knew, for example, that *well-deserved* required a hyphen and *New Deal* needed capital letters when following the word *Roosevelt's* but not in a sentence about poker. ViaVoice is also smart about numbers, dates, currencies, and measures, and it lets you specify your preferred formats.

Modeless operation lets you switch smoothly between dictation, correction, navigation, and formatting. To correct a misrecognized word, you select it and say "Correct this." A list of alternatives appears in the correction window, and

Similarity in Task

We rate speech recognition software in four categories. The ratings, included in the report cards that accompany each review, are based on a range of *poor* (★) to *excellent* (★★★★).

SETUP AND TRAINING This includes the installation and setup procedures for both hardware and software, initial and subsequent voice training, and the program's ability to import documents to extend its vocabulary.

EDITING AND FORMATTING We evaluate the dictation procedure, especially ease of document editing and formatting using a combination of voice and keyboard commands. Large active vocabularies and true modeless operation are also critical.

APPLICATION INTEGRATION We evaluate the program's ability to support dictation and voice commands within other applications, such as word processors. Support for natural-language commands is important.

COMMAND-AND-CONTROL In this task, we look for the ability to control Windows and applications using voice commands. Typical tasks include opening menus, selecting options in dialog boxes, and switching between active windows or applications.

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Index	Value	% Change
Dow Jones	8885.28	+0.11
S&P 500	1127.22	+0.11
NASDAQ	1071.56	+0.11
Russ 1000	2751.68	+0.11
Hong Kong	2754.58	+0.11
Nikkei 225	10715.00	+0.11

Symbol	Price	% Change
AT&T	47.11	+0.11
IBM	170.00	+0.11
Microsoft	60.00	+0.11
Oracle	60.00	+0.11
Sun	60.00	+0.11

Symbol	Price	% Change
Alcatel	11.11	-0.11
Boeing	11.11	-0.11
General Electric	11.11	-0.11
Johnson & Johnson	11.11	-0.11
Walmart	11.11	-0.11

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SOFTWARE

Speech Recognition

IBM ViaVoice 98 Executive

VERDICT: An innovative product that integrates tightly with other applications and offers leading-edge command-and-control features. But ViaVoice's mediocre performance on our tests, including an average accuracy of 85 percent and relatively low throughput, kept it from the top tier.

	POWER	EASE
SETUP AND TRAINING	A++	A++
EDITING AND CORRECTION	B++	B++
APPLICATION INTEGRATION	C++	C++
COMMANDS AND GESTURES	A++	A++

REVIEWER'S COMMENTS "In terms of command-and-control, I found it to be a pretty appealing product. Creating a table in Microsoft Word using ViaVoice's natural-language commands was easy."

and adjust the speed and other traits for optimal quality.

Our main disappointment with ViaVoice is that it didn't

yield a high level of recognition accuracy, garnering an average accuracy score of only 85 percent. Another concern is that its accuracy was

highly inconsistent, with an expected accuracy that ranges from 79 to 92 percent. And despite its modelless operation and intuitive handling of ambiguous words, ViaVoice's throughput ranked near the bottom on our tests.

IBM ViaVoice 98 offers some compelling features but until its accuracy improves, it will remain a program that is better at giving

orders to your PC than it is at taking down what you say.—Craig Stinson

L&H Voice Xpress Plus 1.01

\$70 street, including the Andrea Electronics' NC-80 microphone headset. Lernout & Hauspie Speech Products USA Inc., Burlington, MA; 800-380-1234, 781-203-5000; www.lhs.com. 519 at www.pcmag.com/infolink.

● Although it arrived a little late to the party, Lernout & Hauspie Speech Products' L&H Voice Xpress Plus has quickly made its presence felt by forging close ties with Microsoft Word (Microsoft is an investor in Lernout & Hauspie Speech Products). At \$70 street, Voice Xpress is a lower-priced alternative to Dragon NaturallySpeaking. But in order to get good accuracy, you must be willing to spend a fair amount of time training the program and learning its nuances.

Installation and speaker profile setup is a snap. After we tuned its microphone and audio system, they received a score of *excellent* for signal quality. During actual dictation, we had trouble keeping the bundled Andrea NC-80 headset's mouthpiece positioned properly, which can adversely affect accuracy.

New users must complete a Speaker Enrollment, which requires roughly 45

you can select the appropriate one by voice. If the right word isn't there, you can type it in a text box or begin spelling it. You can also change the format of a word from the correction window. Words that you change during correction are automatically added to your active vocabulary if needed. You can also add words en masse by importing files into ViaVoice's Vocabulary Expander.

The Executive edition includes specialized Computer and Business and Finance vocabularies and, most important, natural-language integration with Microsoft Word 97. This allows you to navigate in

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PERFORMANCE TESTS

Speech Recognition Software



Among the speech recognition programs we tested, one product currently stands above the rest: **Dragon NaturallySpeaking**.

NaturallySpeaking was the only product that approached the level of accuracy we'd like to see in this developing category.

To gauge accuracy, we used several different tests. In the first test, we asked a team of six testers with no dictation experience to dictate a series of documents into each program. NaturallySpeaking came out on top. On a 1,000-word business document, NaturallySpeaking will make 38 fewer word errors than its closest competitor, L&H Voice Xpress Plus. That's good, but you'll still wind up with an average of 91 errors to correct.

To provide a more comprehensive picture of the results you can expect, we calculated the range of accuracy results that users will typically receive after completing the basic training. The result: NaturallySpeaking provides 87 to 95 percent accuracy virtually out of the box. Voice Xpress and IBM ViaVoice are average, but Philips FreeSpeech98 probably won't crack the 90 percent mark.

To see how additional experience with dictation and speech recognition software would affect accuracy, we invited each of the vendors to complete our tests using PC Magazine Labs' test systems and their own test systems with a well-developed speech file. The results were telling: Accuracy increased by as much as 5 percent (FreeSpeech98) to 9 percent (ViaVoice). On some documents, Dragon Systems' tester achieved 98 to 99 percent accuracy.

Our throughput tests measure the speed at which testers produced documents that were 100 percent accurate using speech recognition software. We performed three throughput tests: dictate and correct with voice only; dictate and correct with minimal keyboard use; and dictate, correct, and format with minimal keyboard use. For the latter two tests, we also measured throughput using the keyboard and mouse only, for comparison purposes. On our first two tests, the average throughput ranged from about 10 to 18 wpm. On the average, testers could have completed the same task using the mouse and keyboard at a rate of 24 words per minute. The story is not in the averages, however, but in the individual scores. Tester 3, who can only type documents at a rate of about 10 wpm, could double productivity on these tasks by using NaturallySpeaking or Voice Xpress.

THROUGHPUT Words per minute

High scores are best.

1 2 3 4 5 6 Average

PC denotes Editors' Choice.

DICTATE AND CORRECT (voice only)							
Dragon NaturallySpeaking 3.0	9.1	17.5	14.5	15.9	26.6	12.5	16.0
IBM ViaVoice 98 Executive	5.6	14.0	12.0	10.7	10.7	4.8	9.6
L&H Voice Xpress Plus	11.8	15.7	8.5	19.4	19.4	17.9	16.5
Philips FreeSpeech98	5.7	12.0	15.0	3.4	13.5	9.1	9.8

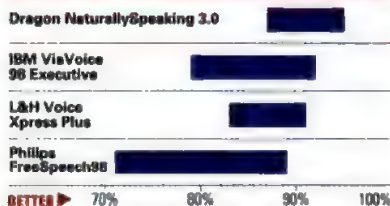
DICTATE AND CORRECT (some keyboard)

Dragon NaturallySpeaking 3.0	8.7	23.2	19.7	10.7	20.9	23.1	17.9
IBM ViaVoice 98 Executive	9.8	16.5	15.5	8.9	11.7	13.8	12.8
L&H Voice Xpress Plus	17.2	16.5	24.8	16.1	17.5	18.4	18.4
Philips FreeSpeech98	8.1	23.7	16.5	4.6	13.4	15.3	14.2
Keyboard only	33.1	30.8	10.3	16.0	33.2	19.4	23.8

DICTATE, CORRECT, AND FORMAT (some keyboard)

Dragon NaturallySpeaking 3.0	5.1	14.8	11.8	8.7	35.8	8.4	11.7
IBM ViaVoice 98 Executive	4.9	8.6	11.0	5.6	6.3	2.5	6.6
L&H Voice Xpress Plus	9.2	12.5	6.2	2.9	18.0	8.3	10.3
Philips FreeSpeech98	4.5	6.8	7.8	3.6	9.6	12.0	7.4
Keyboard only	18.3	21.0	9.4	9.2	23.3	18.1	16.0

EXPECTED ACCURACY
Based on our tests, 90 percent of users can expect to get these results after completing the basic training.



▲ The two most accurate programs, Dragon NaturallySpeaking and L&H Voice Xpress Plus, also posted the top throughput scores. But none of the products actually enabled our testers to complete a document more quickly than with the keyboard.

How We Tested

Our test team consisted of six people: three men and three women. We tested each program using its default settings, and completed the level of training recommended by each vendor. Before beginning the tests, we imported a series of documents into each program to expand its vocabulary and enhance its accuracy. Using the microphones supplied by each vendor, each of the testers dictated a series of documents.

To measure throughput, we asked each tester to repeat the test and correct the document using voice only and then using a combination of voice and minimal keyboard strokes. Finally, we asked each tester to repeat the test and apply formatting to the document using voice commands and some keyboard strokes.

All tests were conducted using a NEC Direction SPL300 (a 300-MHz Pentium II PC) with 128MB of RAM, running Windows 98, and with a Creative Labs Sound Blaster AWE64 Gold sound card.—Analysis written by Diane Jecker

◀ Dragon NaturallySpeaking is the performance leader. It was the most accurate not only on our tests but also on those completed by the company's tester. IBM ViaVoice 98 and L&H Voice Xpress Plus were middle-of-the road, and Philips FreeSpeech98 ranked last, with an average score of about 80 percent.

ACCURACY Percent

PC denotes Editors' Choice.

High scores are best.

1 2 3 4 5 6 Average

Dragon NaturallySpeaking 3.0	93.2	92.9	81.7	95.0	91.0	91.6	90.9
IBM ViaVoice 98 Executive	89.3	89.6	70.7	92.0	86.4	84.2	85.4
L&H Voice Xpress Plus	93.0	91.1	82.1	84.9	89.6	81.7	87.1
Philips FreeSpeech98	86.8	88.3	68.2	82.4	88.8	64.8	79.9

Vendor Tests:
PC Magazine test-bed Vendor test-bed

Dragon NaturallySpeaking 3.0	97.0	96.9
IBM ViaVoice 98 Executive	92.6	94.2
L&H Voice Xpress Plus	91.9	93.5
Philips FreeSpeech98	85.4	84.0

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word. Then you can train or accept it. Also, you can't completely train a word without the keyboard or mouse. Voice

Xpress has a text-to-speech feature but, as with NaturallySpeaking, we had trouble understanding the synthesized voice.

Voice Xpress was very good at recognizing numbers in context. Dollar signs, commas, and decimal points were added to currency and phone numbers were automatically formatted. The powerful SmartText feature let us create word macros for common items. Features like this helped boost Voice Xpress's throughput speed, which rivals NaturallySpeaking's. On our Dic-

tate and Correct test that allowed for some keyboard use, Voice Xpress came out on top (18 wpm).

The highlight of Voice Xpress is its natural-language command capabilities. Though NaturallySpeaking and ViaVoice also offer this feature, Voice Xpress provides more flexibility. And if you still can't come up with the wording to execute a command, you can summon Voice Xpress's Command Browser and type in part of a command such as "insert table" to view all the possible commands.

Like ViaVoice, Voice Xpress allows full control over all Word 97 menus and commands. You can't dictate into or control any other Windows applications with this version, however. By the time you read this, Lernout & Hauspie should have released Version 2.0 of Voice Xpress, available in three versions, including a Professional version (\$150 street) that supports natural lan-

guage commands across all Microsoft Office applications. Version 2.0 will not include a new recognition engine, so accuracy should remain about the same.

L&H Voice Xpress Plus is a promising product. As its accuracy improves and it expands to support more applications, Voice Xpress should mature quickly into a serious contender.—GA

Philips FreeSpeech98

\$39 direct, microphone not included. Philips Speech Processing, a subsidiary of Philips Electronics N.V., Atlanta; 800-899-6837, 770-821-2400; www.speech.philips.com. 520 at www.pcmag.com/infolink.

● Targeted at home and SOHO users, Philips FreeSpeech98 is a limited speech recognition solution. FreeSpeech98 is distributed directly from Philips only, but it does not include a microphone or printed documentation. Its accuracy lagged far behind the other products reviewed here. And FreeSpeech98 lacks many of the features found in other programs, such as support for multiple users, true modelless operation, and voice macros.

Though Philips says you can use any high-quality microphone, the company recommends its own, the Philips SpeechMike (\$69.95 direct), a combination handheld mike and trackball device. We tested FreeSpeech98 using the SpeechMike.

VERDICT: Highlights of Voice Xpress include tight integration with Microsoft Word 97, support for natural-language commands, and a SmartText feature that streamlines dictation. Although its accuracy scores were respectable, Voice Xpress is missing some features.

	POWER	EASE
SETUP AND TRAINING	***	***
EDITING AND FORMATTING	***	***
APPLICATION INTEGRATION	***	***
COMMAND AND CONTROL	***	***

PERFORMANCE TESTS
AVERAGE WORD ACCURACY: 87%
EXPECTED ACCURACY: 83% to 91%

REVIEWER'S COMMENTS: "It took a while to get up to speed. Out of the box, basic commands like didn't work reliably. But after two to three days of using it, things got a little smoother."

minutes of dictation followed by another 30 minutes for your system to process and build your language model. Unlike NaturallySpeaking and IBM ViaVoice 98, Voice Xpress won't let you return to the enrollment to fine-tune the speaker profile. All additional training is through dictation and correcting or training of individual words. You can also import documents.

Even after the lengthy enrollment, we had problems with some common words, commands, and even punctuation such as *period*. After retraining the "." symbol, Voice Xpress only missed it occasionally.

Voice Xpress was more sensitive to dictation speed and pauses than the other programs in this roundup. If we paused before saying punctuation marks, they were taken as text. Likewise, if we did not pause long enough before issuing a command, such as "new line," Voice Xpress would insert it as text, rather than execute the command. Once we got the timing down, however, accuracy improved.

On our tests, Voice Xpress achieved the second best accuracy results (87 percent). Most users can expect results ranging from 83 to 91 percent.

To correct a highlighted selection you say "Correct that," but unlike other programs, you aren't given a list of possible matches; you must spell or type the correct

VERDICT: Although it is the lowest-priced product in this category, FreeSpeech98 does not include a microphone, is the least accurate of the programs we tested, and lacks many features. You'll be better off spending the extra money to get a more powerful solution.

	POWER	EASE
SETUP AND TRAINING	***	***
EDITING AND FORMATTING	***	***
APPLICATION INTEGRATION	***	***
COMMAND AND CONTROL	***	***

PERFORMANCE TESTS
AVERAGE WORD ACCURACY: 80%
EXPECTED ACCURACY: 72% to 87%

REVIEWER'S COMMENTS: "The biggest limitation is that it requires mode switches every time you turn around. That means there's no way to easily integrate the dictation with keyboard use."

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- **E-mail** + contact name opens and addresses a new e-mail form.
- **Fax** creates and addresses a new fax form. (Requires bFax Express).
- **Show Details** + contact name to display the complete record.
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SOFTWARE

Speech Recognition

Setup is straightforward. The program walks you through an audio-tuning process and some initial training. To set up your voice profile, you must read into the microphone for about 15 minutes. The system spends another 15 minutes processing your input. A green light on FreeSpeech98's toolbar lets you know when you're in a program that can accept

voice input; most programs can.

The 30,000-word working dictionary is geared more toward personal correspondence than business and technical matters. In practice, that means you may need to add more proper nouns and topic-specific words to its initial lexicon. You can expand the working dictionary to a maximum of 64,000 words, drawing from a

270,000-word backup dictionary or adding your own words.

Like the other products in this roundup, FreeSpeech98 lets you supplement the working dictionary by importing documents. But any words that are adjacent to punctuation are added with the punctuation attached, rendering them useless. Also, during our tests, when we imported DOC files, the program invariably crashed. Philips was unable to reproduce the error and was still investigating the problem when we completed our story.

Unlike IBM ViaVoice 98 and L&H Voice Xpress Plus, FreeSpeech98 does not let you create speech macros for entering common text strings. The program also lacks text-to-speech capability. You can, however, play back recordings of your own dictation. Finally, FreeSpeech98 lacks support for multiple users.

In use, FreeSpeech98 is relentlessly modal. While you dictate, the program locks out the keyboard, so you can't make minor adjustments without switching from dictation mode to command or correction mode. If you come to a word that you know FreeSpeech98 isn't going to recognize, you can spell it out, but only after you quit dictation mode and enter spelling mode. In correction mode, the program offers a pick list of alternatives to the selected word, but if the word you want isn't there, you can't enter it in the correction window.

On top of these difficulties, we found several rough edges in the Philips entry. During dictation, FreeSpeech98 occasionally suppressed the display of Word's insertion point, making it difficult to determine exactly where our next utterance was going to land. And when it switched between dictation and correction modes at the start of a new line or paragraph, the program inexplicably moved the insertion point back one line.

With an average score of 80 percent, FreeSpeech98 was clearly the least accurate program. Typical users can expect to achieve accuracy levels between 73 and 87 percent. FreeSpeech98 fared slightly better on throughput tests, however.

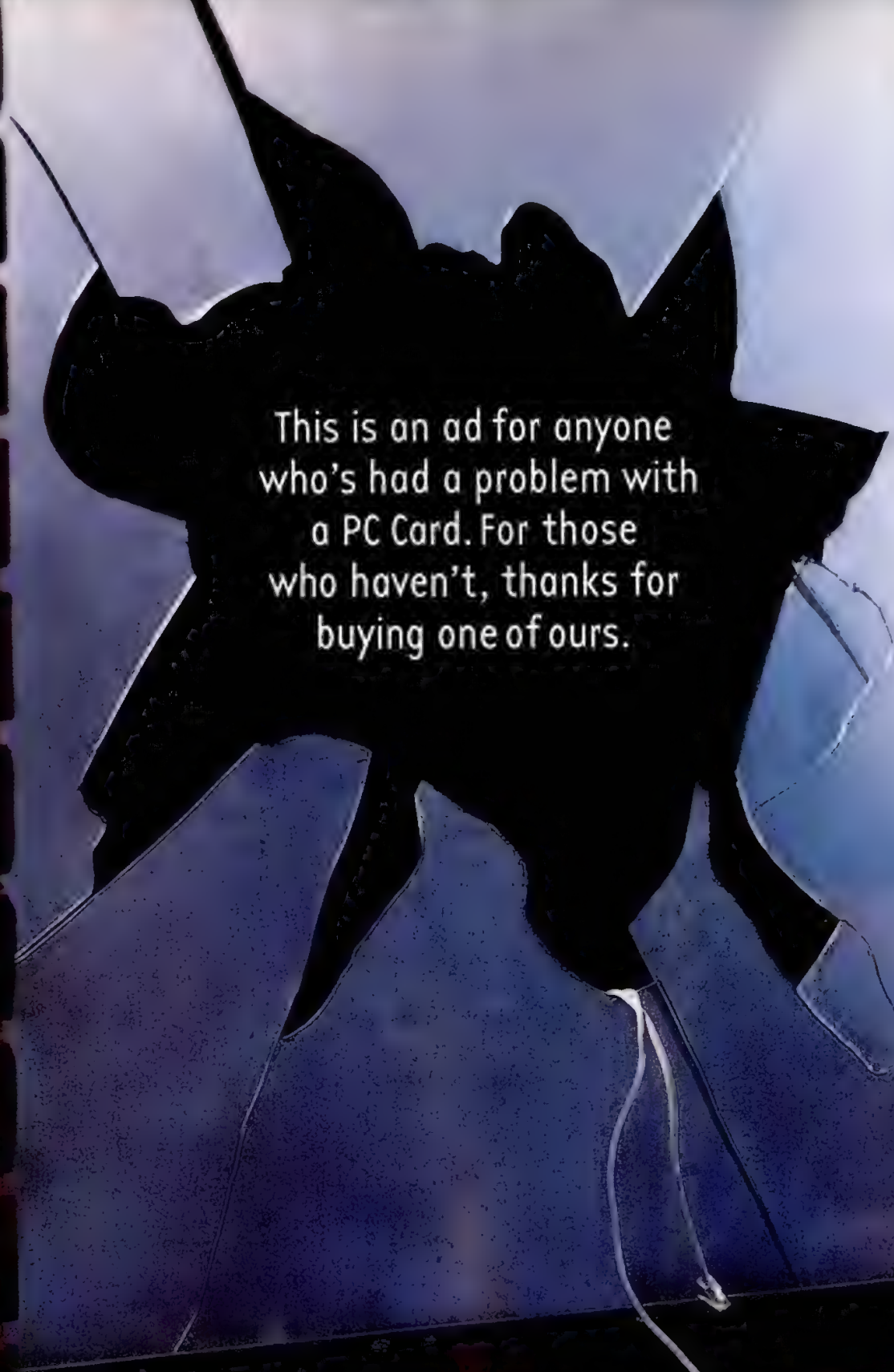
Philips FreeSpeech98 presents too many compromises in its efforts to reach a SOHO audience. No matter what type of documents you plan to dictate, you'll be better off spending a little extra for one of the other solutions reviewed here.—CS **PO**

Speech Recognition Software				
	Dragon NaturallySpeaking 3.0 Preferred Edition	IBM ViaVoice 98 Executive	L&H Voice Xpress Plus	Philips FreeSpeech98
Street price	\$150	\$150	\$70	\$39 (direct)
System requirements	Pentium/133 PC or better, 32MB RAM (48MB for Win NT), 180MB hard disk space, 16-bit SoundBlaster-compatible sound card (www.naturallyspeaking.com has a list of compatible cards), Windows 95, 98, or NT 4.0.	Pentium/166 PC or better with MMX and 256K L2 cache, 32MB RAM (48MB for Win NT or for natural-language integration with MS Word 97), 180MB hard disk space, 16-bit sound card, Windows 95, 98, or NT 4.0.	Pentium/166 PC with MMX, 40MB RAM (48MB for Win NT), 130MB hard disk space, 16-bit SoundBlaster-compatible sound card (www.lhs.com has a list of compatible cards), Windows 95, 98, or NT 4.0	Pentium/166 PC or better, 32M RAM (48MB for Win NT), 150MB hard disk space, SoundBlaster-compatible sound card, Windows 95, 98, or NT 4.0
Included microphone headset	VXI Parrott 10-3; comfortable and performed well.	Andrea NC-90; not as comfortable as the VXI Parrott 10-3.	Andrea NC-90; not as comfortable as the VXI Parrott 10-3.	None; Philips recommends its SpeechMike, (\$69 95 direct)
Setup and training	Wizard configures hardware and trains the system to recognize your voice in about 4 minutes. To improve accuracy, you can read from one of four popular works for about 30 minutes.	Wizard adjusts speaker- and microphone-volume levels. To train the system, you read from a selection of texts. Process takes about 30 minutes. ViaVoice also has five quick product tours.	Wizard configures your hardware. During enrollment, you read a chapter of a book. The entire process took over an hour on our tests. Note that you can't return to the enrollment phase to enhance accuracy.	Wizard configures your hardware. You then read a selection of text for approximately 15 minutes, and FreeSpeech adjusts its language model. Program also has ten training topics.
Base active vocabulary/Maximum active vocabulary/Backup dictionary (words)	30,000 / 62,000 / 230,000. Add new words with Vocabulary Editor and import documents using Vocabulary Builder.	64,000 / 128,000 / 260,000. Program automatically prompts you to add unknown words, and you can import documents.	30,000 / 60,000 / 230,000. Can add new words with the Vocabulary Tool and import documents.	30,000 / 64,000 / 270,000. ConText Tuner lets you import documents and Adaptation Wizard adds new words during correction.
Support multiple users/dictionaries	Yes/Yes	Yes/Yes	Yes/Yes	No/No
Modeless operation	Yes. You can switch between dictation and commands on the fly.	Yes. Provided you pause before and after a system command.	Yes. Normal mode allows both dictation and commands.	No.
User can correct by spelling words	Yes. Say "Spell that" in any mode.	Yes.	Yes. In the Correction dialog or in Spell mode.	Yes. In a separate Spell mode only.
Can play back dictation for proofreading/Can convert text to speech	Yes/Yes	Yes/Yes	No/Yes	Yes/No
Application integration	Integrates with Corel WordPerfect and MS Word. Dictates to most applications using Natural Text.	Integrates with MS Word 97. Dictates to any application that accepts text. Natural-language commands work in both ViaVoice's Speakpad and Word 97.	Integrates with MS Word. User can dictate directly into Word only.	Integrates with MS Word. User can dictate to most applications, including Corel WordPerfect and Lotus WordPro.
Command-and-control	Yes. Basic command-and-control, but does not offer full control over Word 97 menus.	Yes. Full control of most Windows applications.	Yes. Extensive command-and-control in Word 97.	Yes. In command mode only.
Supports macros for commonly used phrases	Yes. Up to one line only.	Yes. Macros can be more than one line.	Yes. Macros can be more than one line.	No.

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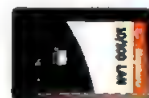
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Bulletproof Data

Today's affordable, hardware-based RAID systems add capacity while providing uninterrupted access to data.

By Steve Rigney

With external disk subsystems and hot-swappable, fault-tolerant components, hardware-based RAID systems were once a luxury afforded only by big-budget businesses with the means to set up and maintain them. But lower prices and improved ease of use make the new generation of products a tempting solution for smaller companies that have traditionally relied on the less powerful, software-based RAID solutions in NetWare and Microsoft Windows NT.

Add-on RAID solutions connect to your exist-

ing server to increase capacity and protect your data from server crashes. For this story, we tested four products, two host-based and two SCSI-to-SCSI-based. They include a minimum of 40GB of hot-swappable RAID Level 5 disk storage each, and they range in list price from \$5,000 to \$18,000.

HOW RAID WORKS

The idea behind *RAID* (Redundant Array of Inexpensive Disks) is simple: Combine multiple hard disks into an *array*, then write your data over the disk drives in a way that prevents you from losing

INSIDE

RAID for the Rest of Us:

Lower prices and increased ease of use are making hardware-based RAID solutions a viable choice for small to midsize businesses. Contributing editor Steve Rigney puts four such systems to the test.



Get Your Free NOS: ZD Labs' Ryan Snedegar takes a look at FreeBSD 2.2.7, an open-source-code NOS. Do you get what you pay for, or is this the bargain of a lifetime? *Page 227.*

Drowning in E-Mail? Without proper management, corporate e-mail can overwhelm a company. Contributing editor Les Freed tests Micro Computer Systems' Calypso Message Center 1.1 and Mustang's List-Caster 2.0. *Page 227.*

Just the Fax: The Castelle FaxPress 3500 is now loaded with FaxPress 5.0 software. Contributor Padraic Boyle sees if it delivers. *Page 232.*

All-in-One: Have a small network that you want to connect securely to the Internet? Steve Rigney examines the SonicWall Plus, a turnkey box that provides all the services you'll need. *Page 234.*

Is Your RAS Sick?

Steve Rigney inspects Concord Communications' Network Health—Remote Access, a diagnostic program for remote-access installations. *Page 238.*



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RAID SYSTEMS

data if one or more drives fail. The RAID specification is broken down into configurations, or *levels*, which define how the data is written.

In short, RAID uses *disk spanning*, or *striping*, which spreads the data across all the disks in the array; *disk mirroring*, which duplicates the data on every disk; *parity checking*, which stripes the data across multiple disks, then uses the parity in case of failure; or *error correcting*, information and a special algorithm to rebuild the data. (For details, see the sidebar "Many Levels of RAID.")

Most NOSs include software-based RAID capability, but that provides data striping and mirroring only, not parity checking, which is the most popular and efficient technique. Moreover, performance is slow, because the server's processor controls the array. Hardware-based RAID products are superior, providing built-in CPUs for faster performance and a broader range of RAID levels.

SCALABILITY AND PERFORMANCE

Hardware-based solutions are either *host-based* or *SCSI-to-SCSI*. Host-based systems (the Artecon RAIDPro XL and Compaq ProLiant Storage System/U1) put the RAID array controller inside the host server; in SCSI-to-SCSI systems (the Dynamic Enterprise 6665 and Optima GigaBank), the controller resides

in a separate subsystem that connects to the server via a standard SCSI adapter.

While host-based products tend to be faster, SCSI-to-SCSI products are more flexible and scalable, using a single SCSI ID on the server-based adapter to which you can connect seven additional SCSI-to-SCSI RAID subsystems. The SCSI-to-SCSI products we tested work with any NOS or SCSI adapter and don't require NOS drivers (other than a SCSI driver), as host-based solutions do. With a host-based system, you can scale only by increasing the capacity of your hard disks in the existing subsystem.

Host-based systems have the potential to be faster because they transmit data directly across the server's bus. SCSI-to-SCSI solutions require data to travel the length of the SCSI cable before reaching the server's CPU. On our Direct Read test (one of our Data Throughput tests), the four products performed within about 30 percent of one another. But on our Database Application test, the difference in architectures was more obvious. The host-based Compaq unit easily outpaced the competition, delivering a dramatically faster speed than the SCSI-to-SCSI products. (See the "Performance Tests" section for details.) Though the Artecon unit trailed the other three products on this test, its score fell within an acceptable range.

The Artecon unit's design, feature set, and ease of use win it an Editors' Choice.

Scan the features table and performance charts for the capacities and speeds of the products we tested. For more power, consider RAID solutions that work with Fibre Channel, a connection technology that allows for faster speeds and greater scalability. (See the sidebar "SCSI vs. Fibre Channel.")

EASE OF USE

As demonstrated by our Editors' Choice pick, products targeted to small and midsize businesses need to be easy to install and configure. Although none of these devices required less than 2 hours to install, the Artecon unit was the easiest to set up and use.

All the products here let you view basic information and status from the subsystem, and all but the Dynamic unit include remote management and configuration. We especially liked the Artecon unit's RAIDScope utility, which let us monitor the subsystem and change the array configuration. All but the Optima unit include a notification feature that sends an e-mail alert, network broadcast, or SNMP trap when there's trouble.

All the products here include hot-swappable and redundant power supplies, disk drives, and cooling fans. But some designs made replacing fault-tolerant components challenging. The Dynamic unit's four cooling

RAID SPECIFICATION

Many Levels of RAID

The RAID specification consists of several configurations (or levels) that determine the number of disks in the array, how the data is written to the disks, and in some cases, the performance of the disk I/O. Although there are only six RAID levels (0 to 5) that everyone agrees on, many vendors have created their own, such as 6, 7, 10, 11, and 35. Ostensibly, these are combinations of standard levels; for example, Compaq's Level 0+1 combines Levels 0 and 1. Eventually, these may make it into the mainstream, but today most network administrators stick with the most common RAID Levels: 0, 1, 3, and 5.

Level 0 *stripes* (*spans*) the data across multiple disk drives. This kind of configuration gives you no redundancy, but it gives you the best speeds by writing and reading from only a single logical disk at a time. But if one drive fails in a Level 0 array, the sys-

tem goes down. It requires at least two disks and is especially useful for adding disk capacity to the server without adding a new volume name.

Level 1 uses *disk mirroring* to provide the most redundant fault tolerance available. Each time you write or change data, the same change is also made to a second disk. When a disk fails, the second one takes over. If, however, corrupt data is written to one disk, it is also mirrored on the second disk. Mirroring is impractical and expensive, especially if your capacity reaches into the hundreds-of-gigabytes range. Even with the dropping cost of hard disks, Level 1 makes sense only for mission-critical data. Levels 0 and 1 each require at least two disks to implement.

Level 3 introduces *parity checking*, or *error-correcting*. It stripes the data across multiple disks at the byte level and adds

redundancy by using a dedicated parity disk that recreates the data after a disk failure. If the parity disk fails, you've lost your redundancy, but your data remains intact. Level 3 is costly, because it requires you to devote an entire disk to parity information. Because it writes data in big chunks, Level 3 is good for applications such as video that send and receive large files.

Level 5 is the most popular solution and is the level we configured the products in this story to use. Like Level 3, Level 5 creates parity data but stripes the data across all the disks, obviating the need for a dedicated parity disk. Level 5 is the most redundant of the striping levels, because if one disk fails, the parity information on the others can work together to rebuild it. Moreover, Level 5 writes data to the disks at the block (rather than the byte) level, making it better suited to multiple small transactions such as e-mail, word processors, spreadsheets, and database applications. Levels 3 and 5 each require at least three disks to implement.

fans are located on a single backplane, so replacing a single fan was difficult. Likewise, the door on the Artecon unit's chassis got in the way when we tried to remove the disk from the first drive bay. To test fault tolerance, we removed components with the units running, then noted their reactions. Each sounded an alarm, but the Optima unit required a system reboot before noticing a missing power supply.

If constant access to your data is important, look to the Artecon. Its controller provides Artecon's Dynamic Growth and Reconfiguration (DGR), which enables you to add capacity to the array and change RAID levels without switching off the server or rebuilding the array. Turn to the reviews to find out which product hits your sweet spot in terms of features, price, and performance.

Artecon RAIDPro XL

\$12,800 list; \$10,280 street. Artecon Inc., Carlsbad, CA; 800-765-7895, 760-931-5500; www.artecon.com; 900 at www.pcmag.com/infolink.



For a host-based RAID solution that packs excellent features and flexibility into a tiny footprint, look to the Artecon RAIDPro XL (\$12,800 list, \$10,280 street). (Artecon was formerly Storage Dimensions.) The RAIDPro was the only product here that let us add disk space and change RAID levels on the fly; no need to create the entire array from scratch. In addition, the RAIDScope management software was powerful and simple to use. The RAIDPro earns our Editors' Choice.

The model we tested included six 9.1GB hard disks, dual hot-swappable fans, three redundant power adapters, a 32MB dual-chan-

EDITORS' CHOICE

• Artecon RAIDPro XL



Traditionally, hardware-based RAID systems have been expensive, complex products, requiring a high level of expertise to install and manage. But with list

prices dipping down to the \$5,000-to-\$15,000 range, add-on RAID boxes have become attractive to small and mid-size businesses that demand all that RAID technology has to offer, plus ease of use.

Of the four vendors whose products we tested, Artecon has done the best job responding to the call. The host-based Artecon RAIDPro XL (\$12,800 list) provides a compelling mix of features, notably a toaster-size footprint, as well as an excellent Java-based management tool that makes management—both local and remote—simple and intuitive. And Artecon's Dynamic Growth and Reconfiguration (DGR) technique lets the RAIDPro add capacity and reconfigure the RAID array on the fly; a feature we haven't seen elsewhere.

Two other products deserve honorable

mention. The host-based Compaq ProLiant Storage System/U1 (\$9,330 street) is a good package, and it distinguished itself as the fastest performer, delivering at least 75 percent more throughput than the competition on our Database Application test. But unless you use the U1 in conjunction with a Compaq server, you'll benefit neither from the management software nor from Compaq's technical support.

If you never thought you could afford hardware-based RAID, look to the Dynamic Enterprise 6665 (\$4,995 list). This SCSI-to-SCSI solution, which uses IDE hard disks to keep the price down, will get you redundant drives, fans, and power supplies, as with the expensive products, and the ability to rebuild a failed array on the fly. It lacks management software and remote capabilities, but the LCD made configuration simple.

nel Ultra SCSI caching controller, cables, and RAIDScope. In view of the large footprints of some RAID towers, we appreciated the RAIDPro's toaster-size chassis. But when swapping disks, we had some trouble removing the first drive, because the open door obstructed the drive bay.

The product typically ships with three

drives installed and configured for RAID Level 5, but we found it easy to switch to Level 0, 1, 3, or 5 and to add disk drives. To configure, you can use any of three methods: a hotkey combination that accesses the BIOS menu of the controller and includes a configuration wizard, the RAIDPro Manager software (a DOS-based utility that also works under Windows NT), or RAIDScope.

We preferred the RAIDScope utility. This is a Java application that runs only on Windows 95 or NT systems; with it, we easily changed RAID levels, monitored errors, and configured notification settings. We especially liked the graphical representation of the logical array, which displays each disk drive and its corresponding array. The program let us view multiple controllers in the same server and provided data on power supplies, cooling fans, and drive bays. RAIDScope tracks how often a disk is removed from a drive bay and sends an e-mail alert when appropriate.

The RAIDPro controller uses Artecon's Dynamic Growth and Reconfiguration (DGR) technique to add space and reconfigure the array on the fly. You can also use DGR to perform other tasks, such as rebuilding a failed drive and array, and setting up a drive as a hot spare. RAIDPro is the only product in

Suitability To Task



	Artecon RAIDPro XL	Compaq ProLiant Storage System/U1	Dynamic Enterprise 6665	Optima GigaBank
Installation	Excellent	Good	Fair	Poor
Flexibility and scalability	Good	Good	Good	Excellent
Management	Excellent	Excellent	Poor	Fair
Fault tolerance	Excellent	Good	Fair	Good

For **installation**, we look for products that are preconfigured and don't assume a preexisting knowledge of RAID or SCSI technology. Drives, cables, and termination features should be clearly labeled, and thorough manuals are a must. We look for intuitive and graphical software.

For **flexibility and scalability**, we expect products to work with multiple operating systems. Management software should work via a Windows-based client and also provide a direct terminal connection. We prefer chassis with high drive-bay capacity, the ability to daisy-chain additional chassis, and expandable caches on array controllers.

Products that let us add capacity on the fly get high marks

for **management**. We also like being able to manage multiple arrays from a single console. The best products monitor power supplies, fans, thermal conditions, and drives, as well as notify you of failure via SNMP, e-mail, or network broadcast.

To judge **fault tolerance**, we evaluate each product's hardware redundancy and RAID implementation. Hot-swappable drives, power supplies, and fans must be easily exchanged without shutting down the system, and products that require the removal of screws to access components receive lower marks. We prefer systems that provide RAID levels 0, 1, 0+1, 3, and 5 and are impressed with products that can change RAID configurations online without data loss.



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RAID SYSTEMS

our roundup that let us change RAID levels without losing data or even restarting the server.

The device turned in respectable performance scores on our Data Throughput tests. Though the Compaq U1 beat it (and the others) soundly on the Database Application test, the RAIDPro lost the

least amount of speed on the Read During Rebuild test.

All in all, the RAIDPro's manageability and ease of use make it an excellent

choice for any business seeking to add hardware-based RAID to its network.

Compaq ProLiant Storage System/U1

\$9,330 street. Compaq Computer Corp., Houston; 800-345-1518; www.compaq.com www.pcmag.com/infolink.

● Calling all users of Compaq servers: The Compaq ProLiant Storage System/U1 (\$9,330 street) is a well-designed, host-based RAID solution that blew the competition away on our performance tests; its throughput on the Database Application test was more than twice the average of the other products' scores. Unfortunately for everyone else, the U1 works best with Compaq servers, which makes it the least flexible product here. You'll get the same great performance using another



THE DOOR IS AJAR: Removing the first drive in the RAIDPro chassis is difficult, because the door is in the way.

SUMMARY OF FEATURES

RAID Systems

PC MAGAZINE
EDITORS' CHOICE

■ YES ■ NO

	Artecon RAIDPro XL	Compaq ProLiant Storage System/U1	Dynamic Enterprise 6065	Optima GigaBank
List/street price	\$12,800 / \$10,280	N/A ¹ / \$9,330	\$4,995 / N/A ¹	\$18,000 / \$14,000
Supported RAID levels	0, 1, 3, 5, 0+1, 5+0	0, 1, 5, 0+1	0, 1, 5	0, 1, 3, 5, 6, 7
SCSI-to-SCSI or host-based	Host-based	Host-based	SCSI-to-SCSI	SCSI-to-SCSI
Supported Operating Systems				
NetWare 3.x/4.x	■ ■	■ ■	■ ■	■ ■
Windows NT 3.x/4.x	■ ■	■ ■	■ ■	■ ■
OS/2 Warp	■	■	■	■
Unix	■	■	■	■
RAID Controller				
Amount of cache	32MB	6MB	64MB	32MB
Read/write caching	■	■	■	■
Processor type on controller	Intel i960	AMD 29045	Intel 80486	RISC-i960
SCSI level/number of SCSI channels	Ultra Wide SCSI / 2	Ultra Wide SCSI-3 / 1	SCSI-3 / N/A ²	Ultra Wide SCSI-2 / 8
RAID Chassis				
Chassis dimensions (HWD, in inches)	5.3 x 8.5 x 13.0	21.0 x 10.9 x 22.7	14.0 x 7.0 x 12.2	21.0 x 11.5 x 20.0
Total subsystem capacity	54.6GB	54.6GB	88GB	54.6GB
Daisy-chain subsystems	■	■	■	■
Redundant power supplies	■	■	■	■
Total number of drive bays	6	7	8	8
Speed of disk drives (rpm)	7,200	7,200 and 10,000	5,400	10,000
Hot-swappable cooling fans	2	5	5	4
Management Software				
Automatic rebuild of failed drives	■	■	■	■
In-band/out-of-band management	■	■	■	■
Change RAID levels on the fly	■	■	■	■
Add capacity on the fly	■	■	■	■
Includes SNMP agent	■	■	■	■

N/A¹—Not applicable: The vendor does not cite this price. N/A²—Not applicable: This device uses an IDE-to-SCSI adapter.

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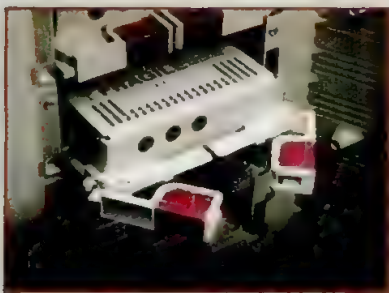
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LOCK DOWN: The clips on the Compaq ProLiant U1's drives and power supplies lock them into place.

er vendor's server, but you'll lose management and configuration functionality, and Compaq won't support it.

The U1 is housed in a standard ProLiant seven-bay tower chassis with three redundant cooling fans; optional dual hot-swappable redundant power supplies are also available. It contains six 9.1GB hard disks and a single Smart-2SL caching array controller, providing equal capacity to the host-based RAIDPro. The drives include unique, easy-to-handle clips with strong tension snaps that ensure a good connection. We found the unit fairly easy to install using the SmartStart utility that configures Compaq ProLiant and ProSignia servers.

The Smart-2SL array controller is an Ultra SCSI-3 device with a single channel and 6MB of cache. It let us select from RAID Levels 0, 1, 5, and 0+1. To build the array, we booted the server using the SmartStart CD and ran the Array Configuration Utility (ACU). Though the ACU was easy to use and provides a graphical view of disk drives and grouping, it didn't let us view a depiction of the subsystem or data on the cooling fans or power supplies, though.

To manage the array and receive notification of failures, you need a separate program, Compaq's Insight Manager, included with Compaq servers. Insight Manager let us monitor the array from a remote PC and gather data on the amount of traffic, status of the components, and array configuration. It also includes a notification feature that sends a network broadcast or e-mail when a drive, fan, or power supply fails.

By the time you read this, the new Compaq UE should be available. Its chassis will be similar to the U1's and will include 12 bays. The accompanying 3100ES controller is expected to add RAID Level 4 capability and let you add capacity on the fly.

Our take on this product: Despite an unbeatable performance, the U1's dependence on Compaq servers is a limitation. Compaq server users, on the other hand, should definitely consider this product.

Dynamic Enterprise 6665

\$4,995 list. Dynamic Network Factory, Hayward, CA; 800-947-4742, 510-733-0103; www.dynamicnetworkfactory.com; 901 at www.pcmag.com/infolink.

● Hardware-based RAID for under \$5,000?

The Dynamic Network Factory has it with the Dynamic Enterprise 6665 (\$4,995 list). This SCSI-to-SCSI solution provides 66GB of disk

storage and even some capabilities you might not expect for the price: redundant fans and power supplies and the ability to rebuild a failed array on the fly. The secret is the use of IDE hard disks, which keeps the price down.

The well-designed mini-tower houses up to six drives. Its front-panel LCD screen was much easier to use than the Optima's similar panel. The Enterprise doesn't include any

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RAID SYSTEMS



DISPLAY TYPE: You can perform several configuration tasks from the Enterprise 6665's front-panel LCD.

management or configuration utilities; everything is done either from the LCD panel—including choosing the SCSI ID, RAID level, and password—or from a terminal connected to the RS-232 port on the back of the device.

Among the products we tested, the Enterprise's use of IDE hard disks is unique. The disks connect to a special bus that converts the interface to an Ultra SCSI connection. This lets you attach the Enterprise to any SCSI adapter in your server and provides SCSI-3 features, such as the ability to daisy-chain several devices to a single controller. Although we liked this design, IDE disks are usually not

as fast as SCSI devices, and our testing bore this out. The unit posted the lowest Data Throughput scores here, though they weren't much worse than those of the other products, with the exception of the pacesetter Compaq U1.

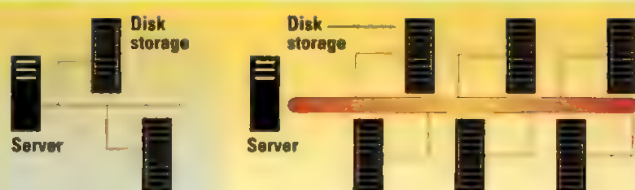
Like the GigaBank, the Enterprise provides a lock on each of the drive bays; the host-based products here each provide only a single lock for the entire subsystem. The device includes two redundant, hot-swappable power supplies and four cooling fans. Though you can replace a fan without turning off the subsystem, we found removing one fan cumbersome while the unit was running. Fortu-

nately, IDE disks don't get as hot as SCSI hard disks, so a failed fan may not damage the system.

Besides management software, the Enterprise also lacks a remote notification feature for cases of drive, fan, or power-supply failure. Although the device will flash a light and sound an alarm upon a component failure, it can't send an SNMP trap to a management console, write information to the operating system's error log, or send an e-mail.

Despite its limitations, the Enterprise has a low price that makes it a good value for any budget-conscious organization.

Storage Connections: Ultra SCSI-2 vs. Fibre Channel

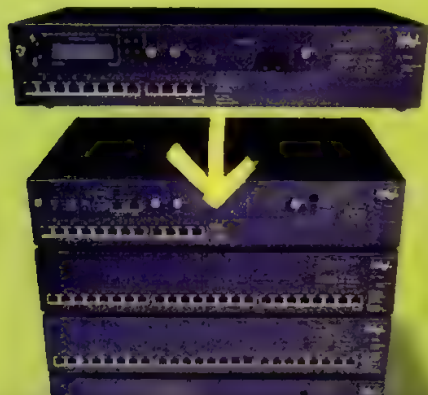


	Ultra SCSI-2	Fibre Channel
SPEED	80 Mbps	800 Mbps
DISTANCE	Up to 3 meters	Up to 10 kilometers
SCALABILITY	Attaches up to 15 devices	Attaches up to 126 devices

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STORAGE CONNECTIONS

SCSI vs. Fibre Channel

The first RAID vendors relied on SCSI to connect disk drives to their host PC. SCSI can handle from 7 to 15 devices on a single connection, provide good performance, and work with nearly all hardware and software platforms. Though SCSI continues to be the most common interface for RAID devices, an alternate technology called Fibre Channel is gaining popularity. This high-speed serial-connection technology was initially developed for use in mainframe and Unix environments. Though it surpasses SCSI in speed, distance, and scalability, only a handful of Fibre Channel products exists, and they can cost thousands of dollars more than a comparable SCSI solution. Two RAID vendors (Compaq and Optima) in this story also offer Fibre Channel RAID systems.

SPEED

The current SCSI technology, Ultra Wide SCSI-2, provides a top speed of 80 MBps.

The Ultra SCSI-3 standard, which debuts in 1999, will provide a top speed of 100 MBps. By contrast, Fibre Channel boasts an impressive raw data throughput of 1.06 Gbps. But once you subtract the overhead produced by the connection, expected performance is closer to 800 Mbps (or 200 MBps for a full-duplex connection). Note, though, that most PC-based servers will never utilize data rates faster than 80 MBps, so anything higher is most appropriate for high-end servers and mainframe hosts.

DISTANCE

As SCSI throughput speeds increase, the distance of the SCSI chain shortens. The first implementation, SCSI-1, provided only 5 MBps of throughput, but the cable could stretch as far as 10 meters. SCSI-2 is limited to about 3 meters, which means you'll quickly run out of room on the SCSI cable for attaching external devices. Differential

SCSI devices are less susceptible to noise and can be placed up to 25 meters apart, but the equipment usually costs more. Fibre Channel devices, on the other hand, can be located as far as 10 kilometers apart.

SCALABILITY

For this discussion, scalability indicates the total number of devices that can be attached to a single cable or *channel*. SCSI has eight IDs, one of which is used by the SCSI controller. Standard SCSI lets you attach 7 distinct devices to one channel. But newer SCSI adapters let you attach up to 15 devices. Moreover, some controllers also provide up to three SCSI channels, which lets you scale up to 45 devices. But for practical purposes, the distance limits you to attaching not more than a few external devices, and the number of possible internal devices is limited by the size of the server chassis. By contrast, Fibre Channel lets you attach up to 127 devices to a single channel. And because you can attach devices along a channel 10 kilometers in length, Fibre Channel is a much more practical way to attach dozens of devices.

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RAID Systems



Picking a RAID system isn't easy. The best product here in terms of scalability, flexibility, and ease of use was the RAIDPro XL. But it wasn't the fastest—not by a mile. And while the Compaq U1 delivered outstanding speed, it's intended for Compaq servers only.

All the vendors here claim Ultra Wide SCSI-2 data throughput speeds of 40 Mbps. But configured for RAID Level 5, these systems delivered less than half that. For the **Direct Read** test (one of our Data Throughput tests), we sent sequential read requests of large blocks of data (256K files) under normal operation. The top-performing U1 achieved a speed of 16.11 Mbps, 30 percent faster than the trailing Dynamic Enterprise 6665. We consider the performance of all the units generally acceptable, though.

Several factors caused the bottleneck, including size and nature of the files, disk drive transfer rate, and the overhead of the SCSI command protocol. For faster speed, consider adding more disk drives or switching to RAID 0+1, which is faster than Level 5 but requires you to duplicate each disk. Another way to boost performance is to split the drives over multiple channels.

For the **Read During Rebuild** test, we simulated a disk failure and measured each system's performance during a data rebuild. Although the U1 sustained the fastest speed, the RAIDPro demonstrated the smallest performance decrease from its Direct Read throughput. The GigaBank and Enterprise turned in poor results, each showing roughly a 60 percent speed decrease.

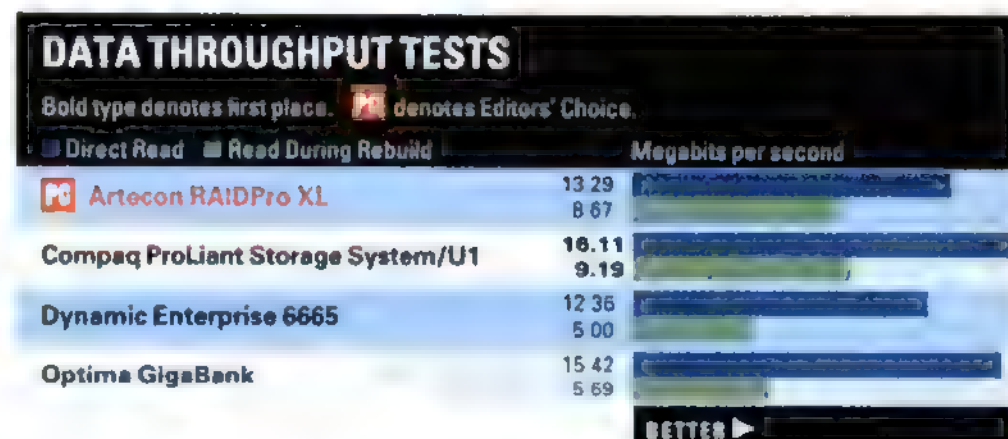
Sheer throughput is only one measuring stick for the devices, though. Each RAID implementation represents complex computing effort; systems are designed to optimize the RAID array engine controller hardware and consisting of an on-board processor, system and cache memory, as well as the SCSI protocol, cache, and management algorithms. The **Database Application** test helped us evaluate the efficiency of the underlying architectures by measuring the rate of transaction processing commands by I/O transactions per second. This simulated the workload of a server application run in the real world. 8K block size requests were made randomly with 67 percent read and 33 percent write opera-

tions, simulating small, random data transactions.

On this test, the U1 outpaced the Enterprise by 76 percent, and the RAIDPro and GigaBank by more than 100 percent. Such numbers reflect the efficiency of the U1's algorithm, which processed requests and transferred data very quickly. We attribute the speed to the size and dynamic nature of the cache on the Compaq SCSI adapter, and the use of read-ahead cache, which predicts read requests and stores them in memory for fast access.—*Analysis written by Jeffrey G. Witt*

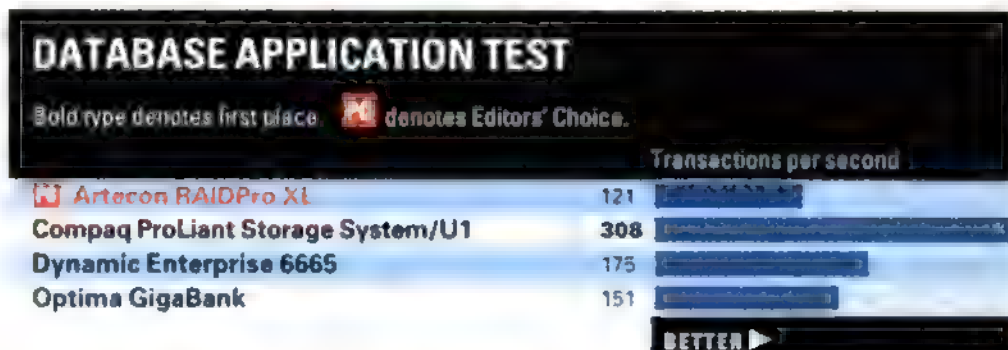
How We Tested

We connected each system to our Compaq ProLiant 1600R server, which contained dual Pentium II/266 processors, 512MB of RAM, and a 4.3GB disk drive for the operating system. We used Windows NT 4.0 with Service Pack 3. For host-based systems, we used the vendor-supplied controller; for SCSI-to-SCSI systems, we configured each unit to the ProLiant Ultra Wide SCSI-3 controller. We then set each array to RAID Level 5 and each controller's cache policy to the manufacturer's default. We used Intel's Iometer, Version 1998.01.05, to stress each RAID array. Intel does not endorse, support, or guarantee results.



▲ Though the Compaq U1 turned in the fastest score on the Direct Read test, the RAIDPro XL

demonstrated the least speed degradation on the Read During Rebuild test.



▲ With a score of 308 transactions per second, the Compaq U1 outpaced its nearest competitor by

more than 76 percent, demonstrating the efficiency of the system's underlying architecture.

Optima GigaBank

\$18,000 list; \$14,000 street. Optima Technology Corp., Irvine, CA; 800-411-4237, 714-476-0515; www.optimatech.com; 902 at www.pcmag.com/infolink.

● The SCSI-to-SCSI-based Optima GigaBank (tested configuration, \$18,000 list) is a mixed bag. It's the most scalable product we tested, and it offers the most RAID levels. But it's also the most costly, it's confusing to install,

and it has poor documentation. If you need to keep pace with an ever-growing data capacity, or require the more obscure RAID levels, the GigaBank is worth considering. But don't commit unless you've got someone savvy on hand to manage it.

The all-metal tower-based chassis subsystem was rugged and well designed. Our test unit included six 9.1GB hard disks, 32MB of RAM on the caching controller, and a SCSI

cable. Unlike the Enterprise, the GigaBank let us daisy-chain up to seven subsystems using a single SCSI ID. The device has eight drive bays and configuration for RAID Levels 0, 1, 3, 5, 6, and 7. Unfortunately, our unit lacked a subsystem manual, making setup a time-consuming process. (Although we tried to find out from the company why we received no manual, Optima was unresponsive.) Each disk drive must be locked with a

Net Tools

RAID SYSTEMS



STORAGE CHAIN: The GigaBank's second SCSI connector lets you daisy-chain up to seven units.

key before it powers up. Though you get good security, losing the key would prevent you from swapping out the drive.

The GigaBank fits into nearly any environment. The array controller resides in the disk subsystem; any SCSI controller in your server can connect to it, and the device works with most OSs. There are two ways to configure the array: either by way of the front-panel LCD menu or by using the basic but useful management utility, SCSI Inspector. The LCD approach is less intuitive than the Enterprise's, though, and the manual was vague and frustrating, failing to explain many LCD menu terms and directions.

The Windows-based Inspector software was much better, but before using it, we had to download the Adaptec SCSI Programming Interface driver because Windows NT doesn't support ASPI. On installation, we could set up

an array to monitor the status of the drives, power supplies, fans, and temperature of the chassis. Optima claimed that our test unit

provided remote notification, but we couldn't find it. The GigaBank sounds an alarm if something goes wrong.

The controller uses the Ultra Wide SCSI-2 standard, whereas the other products here adhere to the faster SCSI-3 interface. Even so, the device turned in the second-fastest score on the Direct Read test. But it did slow considerably on the Read During Rebuild test. On the Database Application test, it bested the RAIDPro.

In summary, the GigaBank's scalability flexibility, and performance don't compensate for a tough installation and high price. **PC**

ALTERNATIVE SOLUTIONS

Toaster Storage

Network Attached Storage (NAS) devices are relatively inexpensive tools that make expanding your existing network easy. Because they contain an embedded operating system and connect directly to the network, they're simple to deploy and manage. We tested three units aimed at small networks and workgroups. They don't provide the same hot-swappable hardware or fault-tolerance features you'll find in the main story, and only one includes support for RAID Level 0+1.

The **Meridian Data Snap! Server** (\$995 list) we tested includes 4GB of EIDE disk space, a 10/100-Mbps Ethernet connection, network cable, and utility software. It contains two disks, but doesn't offer mirroring capability. Snap! has a small footprint, but unlike others here, it lacks external connectors for adding more storage devices. We had no trouble adding Snap! to our Windows 95- and NT-based networks; the system supports DHCP for assigning IP addresses dynamically and also provides a Snap! IP utility for configuring addresses manually.

The browser-based management tool made it simple to add users and create groups. Tools included are used to format and fix drives, and for monitoring status and logging reports. (Meridian Data Inc., Scotts Valley, CA; 888-343-7627; www.snapserver.com; 903 at www.pcmag.com/infolink.)

The **Axis StorPoint HD/4** (\$1,495 list) uses

thin-client operating system technology and 1GB Iomega Jaz Drives, making it ideal for sharing multiple drives or adding removable archiving storage to the network. It lets you connect up to three additional drives via the SCSI-2 connector and uses a 10-Mbps interface. (The others use 10/100 Mbps.) Axis is the only vendor here to include an SNMP agent.

Setup was straightforward, but because the StorPoint lacks a DHCP server, we manually assigned the device's IP address from the command line. We preferred Snap!'s software method and Plug & Stor's front-panel routine. Management is done from a browser, by configuring text files, or via a Windows-based package available by download. Using the browser-based scheme was easy, but we found implementing volume aliases for naming the cartridges confusing. (Axis Communications Inc., Woburn, MA; 800-444-2947; www.axis.com; 904 at www.pcmag.com/infolink.)

The **Creative Designs Plug & Stor 100** (\$995 list) comes closest to matching traditional

server functionality. It includes a 2GB internal hard drive and SCSI connectors for adding disks, CD-ROM, tape, or Iomega Zip (and Jaz) drives. The Narrow SCSI and Ultra SCSI ports accommodate 7 and 15 devices, respectively. The Plug & Stor is the only product here that provides a printer port and uses a Pentium/200-based processor. (The other two use RISC processors.) The lack of a DHCP server required us to configure an IP address manually, by punching the number into a front-panel LCD key-



pad. Administration is performed through Creative's Java applet, EZ-Serv, which works with Microsoft Internet Explorer 4.0 only. Unique to the Plug & Stor are utilities for backup, e-mail notification of problems, and even disk mirroring with RAID Level 0+1. The server lets you add up to 128MB of RAM and a second SCSI port. (Creative Designs Solutions Inc., Santa Clara, CA; 408-653-1330; www.creativedesign.com; 905 at www.pcmag.com/infolink.)

Plug it in, turn it on.



Starting at just \$995, the Snap! Server™ from Meridian Data is everything you want in a storage server. It comes preconfigured to recognize your network, so you really can just plug it in and turn it on — with no downtime for your existing servers. And with prices ranging from \$995 for the 4 GB server to 16 GB for \$2195, Snap! Server redefines network storage, offering the perfect combination of quick and easy installation at prices never-before-seen for a file server. In fact, Snap! Server is so hassle-free, it comes with an unconditional 30-day money-back guarantee. And now, you could win a Snap! Server just by visiting our web site at www.snapserver.com/pcm or simply call **1-888-343-SNAP ext. 100**.



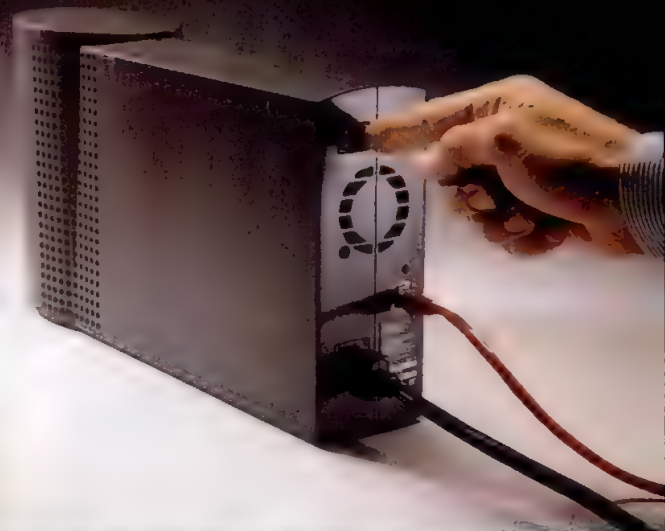
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Net Tools

FROM THE BENCH

OPERATING SYSTEMS

A No-Cost NOS

By Ryan Snedegar

Though you may not have heard of FreeBSD, you've likely encountered it on the Web. Popular with ISPs and Internet companies for its reliability, FreeBSD 2.2.7 is a network operating system based on Berkeley BSD 4.4 Unix. Primarily used to host Internet services, it boasts fast performance and stability—if you have the Unix knowledge to use it.

As the name implies, FreeBSD is open source code, available free on the Internet. A core of programmers created and developed FreeBSD. Though the program is free for download on Web sites, Walnut Creek Software offers a commercial version (\$39.95 list) on a bootable disk that includes a host of software features and documentation.

FreeBSD runs only on Intel x86 platforms and competes primarily with Microsoft Windows NT and Intel-capable Unix flavors such as Linux. Although it lacks Windows NT's ease of use and application support, FreeBSD offers superior stability, security, and speed.

We found installation with the sysinstall program straightforward but not for Unix beginners. FreeBSD's simplest installation option, Novice, provides helpful screens for selecting components to include and preconfigured defaults for many features. But Unix novices might get swamped choosing OS pieces (called *distributions*); more informative setup screens would help. The online documentation is extensive but won't hold a novice's hand. Even so, any user with some DOS experience shouldn't have problems.

Because FreeBSD is primarily a server NOS, most administration can be done remotely through a telnet command line interface. But we downloaded an excellent third-party add-on, Webmin, which lets you perform many common tasks through a simple point-and-click interface.

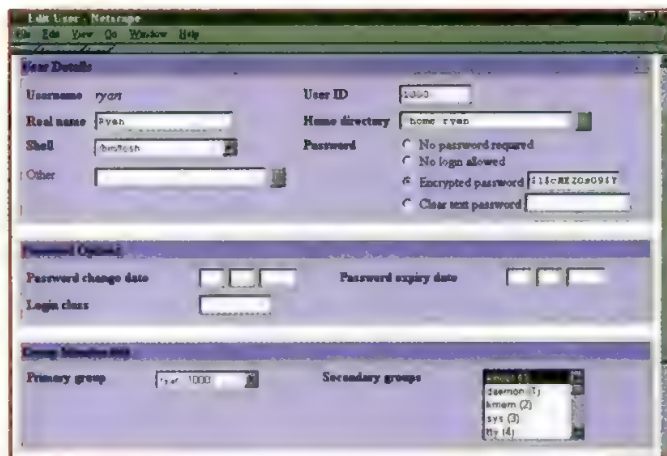
Of course, FreeBSD doesn't provide the hardware and software support of mainstream OSs, but you'll find everything you need to run a server. The NOS can run programs built in a variety of Unix flavors, including BSDI, Linux, NetBSD, and SCO. Free software is

available for download and on the CD for all Internet services, such as Web serving, FTP, and e-mail.

We tested FreeBSD in one of its most common applications: Web serving. We set up two Dell PowerEdge 2200 servers with 128MB RAM and a single Pentium II CPU, installing FreeBSD with Apache 1.3.0 on one and Windows NT 4.0 with IIS 4.0 on the other. On our ZD WebBench 2.0 tests, performance leveled off quickly; memory was the bottleneck for

rienced FreeBSD's reliability firsthand. In our four weeks of testing, we had no crashes. In addition, FreeBSD has a worldwide, 24-hour support network of enthusiasts on the Internet that can actually surpass corporate tech support in certain cases. We got an answer to a problem installing Apache in under 4 hours.

With Unix, security is as good as you make it. The default includes fixes for denial-of-service attacks, and patches to new problems are



SURFING FREEBSD: With Webmin, you can remotely administer FreeBSD users with a Web browser.

both NOSs. FreeBSD outperformed Windows NT by a sizable margin, however. As you increase RAM, Windows NT surpasses FreeBSD because of a cache limitation in Apache and FreeBSD.

The lack of traditional technical support may worry businesses deploying mission-critical applications. But rest assured, we expe-

posted quickly on the Web. The documentation helps you set security as tightly as you need, and free firewalls are also available for download.

FreeBSD 2.2.7. List price: On CD, \$39.95. Walnut Creek Software, Concord, CA; 800-786-9907; www.cdrom.com. 906 at www.pcmag.com/infolink.

MESSAGE MANAGEMENT

Tame Your E-Mail

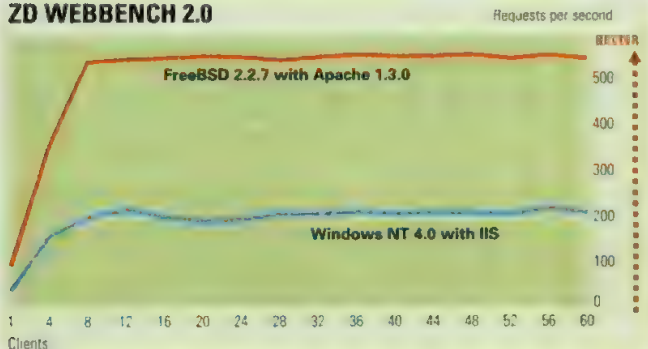
By Les Freed

E-mail is still the workhorse of the Internet, and dealing with huge amounts of it is an ongoing challenge for any business. Whether by stemming a deluge of incoming mail or making sure that important mail gets sent to the right people, corporations need help.

Two programs attack the e-mail management problem from different sides. Mustang Software's

ListCaster is a mailing list server, useful for sending out mail to a large number of users. Think of it as a conference call for e-mail. In lieu of expensive and complicated groupware packages, you can use ListCaster to distribute files, send out periodic mailings to a large number of correspondents, and even conduct discussions. Mustang markets it as an accompaniment to Web servers, including HTML code to let users sign up

ZD WEBBENCH 2.0



CROSS TALK



Frank Derfler

I receive close to 100 e-mail messages on a typical day, Toni, so I'd love a product that would sort messages for action. It looks as if Calypso has some growing to do before equaling Mustang's IMC, but together the two products point to a growing market for e-mail management.

Replying to and routing the incoming corporate e-mail shouldn't be the job of the receptionist, Frank. These packages provide worthwhile automation. I also like the Web-centric applications of ListCaster. It looks like a great way to handle functions such as technical support through a Web site.



Toni Kistner

for mailing lists via a browser.

Micro Computer Systems' Calypso Message Center (CMC) is an inbound mail router that automatically collects and redistributes e-mail for one or more e-mail accounts. If ListCaster is a conference call, CMC is a switchboard operator. Similar to Mustang's Internet Message Center (see the sidebar "Corralling E-Mail"), CMC is most useful for organizations that handle large volumes of incoming e-mail, such as customer service departments, order desks, and marketing groups. CMC lets you track every message and make sure no e-mail goes unanswered. ListCaster and CMC both do their jobs well by helping you deal with the e-mail overload.

Calypso Message Center

If you run a customer service or sales department, every piece of incoming e-mail needs to be answered quickly, or you risk lost sales and disgruntled customers. Micro Computer Systems' Calypso Message Center (CMC), Version 1.1 (\$2,495 list for a server and five clients), operates much like a telephone call center for e-mail messages, collecting e-mail from a group of accounts, distributing messages among workers, and tracking each message to make sure it's answered.

CMC is written in Java, so it runs on most platforms; we tested it on Windows 98 and NT Workstation 4.0. The client and server software

are on the same CD, and you can install the client software on PCs connected to the server. CMC doesn't require dedicated mail accounts or servers, and it works with any POP3 e-mail account.

Installation of the client and server took only a few minutes, but you'll also need to create accounts for all your users, as well as to configure your e-mail account. This sounds more confusing than it really is; CMC provides a helpful planning worksheet to guide you. To handle three incoming e-mail accounts, we set up two groups, with a supervisor and two workers each, in 10 minutes.

CMC has many customizable options. We were able to set the



interval at which the program checks your accounts and to establish rule-based filters for sending back canned replies.

When one of your configured accounts receives a message, CMC places it in the queue for the appropriate agent group: Sales messages get sent to the sales group, and so on. To manage messages, your agents use the CMC client program. Because the server handles all the interaction with the live e-mail accounts, the proprietary client handles all tasks, yet it does not require your PCs to have Internet or e-mail access. Agents can create their own reply or choose from canned replies on the server. You can also forward messages to other departments or supervisors. Once an agent responds, the message and reply are put in a history file, so supervisors can make sure that every message was answered.

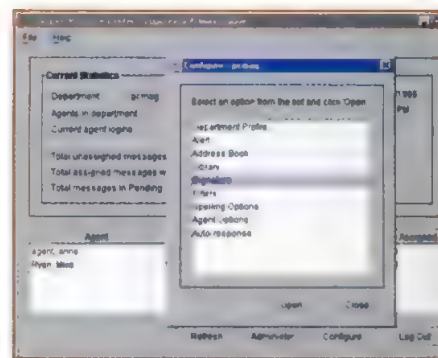
Calypso Message Center, Version 1.1. List price: 5-user license, \$2,495. Micro Com-

puter Systems Inc., Irvine, TX; 800-886-4923, 972-659-1514; www.mcsdallas.com. 907 at www.pcmag.com/infolink.

ListCaster

Dealing with the one-to-many e-mail problem, Mustang Software's ListCaster 2.0 (\$499 list) is a combination mailing list and POP3/SMTP mail server. Providing all the functionality of traditional Unix-based list server programs, ListCaster runs on Windows 95 and NT and is easier to install, configure, and administer.

Like all mailing list programs, ListCaster is a collaborative e-mail utility that provides an end result similar to an NNTP discussion without separate NNTP



MOCHA ADMIN: CMC's Java-based administration works on any Java-capable browser.

ALTERNATIVES

Corralling E-Mail

By Frank J. Derfler, Jr.

Calypso Message Center isn't your only choice for tracking large amounts of inbound e-mail. Mustang Software's Internet Message Center (\$1,500 list for the Business Edition, \$10,000 for the Enterprise Edition) has been on the market since 1997, and we were so impressed that IMC earned a nomination for our Technical Excellence Awards in 1997. Mustang released a point version (2.2) as we went to press. From what we saw, IMC 2.2 offers a mature e-mail call center, providing a wide range of options.

Both Business and Enterprise editions deliver excellent core capabilities. You can block messages to or from specific addresses or domains, store a library of response templates, and use complex mes-

sage-routing abilities. The IMC Monitor provides short-term threaded histories of specific messages, customers, or agents, and IMC Reports handles long-term trend reports. In addition to these features, the Enterprise Edition scales to hundreds of users and thousands of e-mails per day, and you can automate routing with Visual Basic or Perl scripts.

Mustang's experience shows in several key areas. Mustang Services offers a turnkey installation package on top of its telephone support, so customers don't have to do any work. And because IMC is compatible with most Windows and Unix mail clients, agents can use their favorite clients across multiple platforms. Moreover, the IMC Architect development kit (\$7,500 list) lets you hook IMC into other business applications.

Internet Message Center 2.2. List price: Business edition, \$1,500; Enterprise Edition, \$10,000. Mustang Software, Bakersfield, CA; 805-873-2500; www.mustang.com. 908 at www.pcmag.com/infolink.



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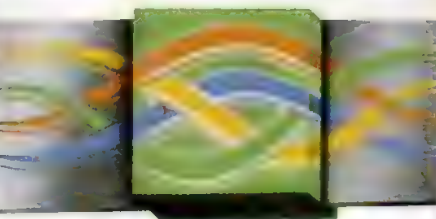
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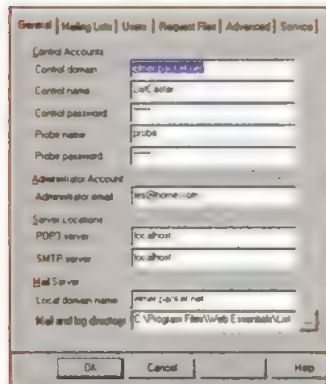
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Net Tools
FROM THE BENCH

servers or clients. You create *lists*, or groups of users, each with its own e-mail address. ListCaster relays mail addressed to the list to all members. A single server can host multiple lists, and users can belong to any number of lists. Administrators can place users in lists, but users have a degree of self-administration, adding and removing themselves by sending *control messages* to the server.

We found ListCaster a breeze to set up and were up and running in under 15 minutes. After installation, we had access to the two management interfaces. A Windows interface will run only locally on the ListCaster server, providing access to simple configuration tools. If you install a Web server on ListCaster, you can use a password-protected



SIMPLE TASK: Administration is as easy as filling in data fields.

10/100 SWITCHES

Cheap and Packed

By Craig Ellison

Longing to upgrade your corporate workgroup switches but worried about the cost? The 24-port HP ProCurve Switch 2400M (\$2,379 list) is sure to ease your mind. It delivers a host of advanced capabilities, plus excellent TopTools management software for just \$99 per 10/100-Mbps port.

The 2400M is a 10/100 auto-sensing, rack-mountable switch. It boasts features commonly found in expensive switches, such as *flow control* to manage heavy port traffic, a *broadcast-throttling filter* to scale back excessive outbound data streams, and support for up

browser interface to access the same tools. Though the browser interface was convenient, the Windows interface was easier to use.

ListCaster doesn't require any special client software, so you can use any mail client you want. A welcome touch was the inclusion of HTML scripts that you can add to a Web page, letting users sign up for mailing lists with one click.

ListCaster has plenty of features to keep users and list administrators happy. In addition to letting you attach files to your list mail, ListCaster includes simple file management capabilities. If you send a control message to the server for a specific file, the program will mail it to you. You can moderate lists, so that all messages receive approval from a moderator before going out to the group. A digest mode sends only summaries of discussions to users, and an automatic acknowledgement tool lets senders know their messages were received.

ListCaster 2.0. List price: \$499. Mustang Software Inc., Bakersfield, CA; 805-873-2500; www.mustang.com. 908 at www.pcmag.com/infolink.

to eight VLANs. It also allows *packet tagging* to help you prioritize traffic on the switch.

Hewlett-Packard bundles a new version of its TopTools management software with the 2400M: TopTools for Hubs & Switches. This version extends the software's network management capability to include all managed hubs and switches on the network. It provides you with real-time, graphical reports on up to 1,500 network segments.

We found installing TopTools straightforward, but it took over an hour to complete. The CD includes all necessary software: Internet

Explorer 4.01, Microsoft PSW/IIS, Windows NT Option Pack 4, and Windows NT Service Pack 4. A wizard smoothly guided us through the Windows NT upgrade and other installations, but the required multiple reboots dragged out the process.

For those who don't need TopTools, HP provides a switch-only Web management interface and a command line telnet interface. The 2400M also has SNMP agents that let you manage the switch from any enterprise management package, such as HP OpenView. In case of trouble, HP includes a



REV UP: HP TopTools for Hubs & Switches gives you graphical real-time status reports.

lifetime warranty and toll-free tech support.

HP ProCurve Switch 2400M. List price: \$2,379. Hewlett-Packard Co., Roseville, CA; 970-625-1000; www.hp.com/ahp/networking. 909 at www.pcmag.com/infolink.

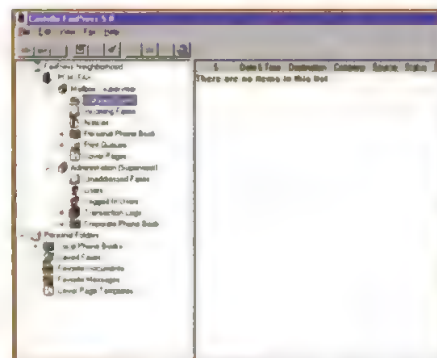
FAX SERVERS

New Face for Faxing

By Padraic Boyle

Sending faxes over the network just got easier with the **Castelle FaxPress 3500** turnkey fax server (\$4,695 list). The device uses the latest version of Castelle's FaxPress software, which touts redesigned, two-paneled graphical interfaces for both the user and the administrator, with a Windows Explorer-like feel for improved ease of use, management, and navigation.

Installation and configuration were a snap. The product includes a new version of Castle's FaxMain management utility, which adds the ability to monitor and manage multiple servers from a central loca-



FAX EXPLORER: FaxPress's Explorer-like interface provides intuitive navigation and control.

tion—useful for extending fax services to branch offices. We used FaxMain to set up fax lines, user names, and access privileges; we were also able to import users from Windows NT groups and Novell's NDS, a quick way to add large groups of users. Although the interface is clean, less experienced users may find the sheer volume of options overwhelming. Our only difficulty was in getting the FaxPress to recognize our NetWare printer.

FaxPress 5.0 includes a host of new client options. We were most impressed with the Tray Fax Alert, a tray icon that notifies users after receiving a fax. The Personal Area is similar to Windows 95's Favorites feature, giving you quick access to your most used faxes and cover letters. Personal Signature lets you tack your name and full contact information onto each fax.

The client interface lets you fax in a variety of ways. Users can send and receive transmissions from standard fax machines, from other Castelle units, or direct-

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FROM THE BENCH

FaxPress 5.0 has full SNMP support to permit complete integration into enterprise management packages such as HP OpenView. **Castelle FaxPress 3500.** List price:

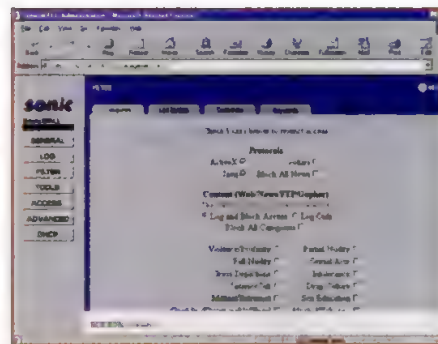
Wall of All Trades

When you're connecting your SOHO LAN to the Internet, you'll want a firewall to stop intruders, content filtering to enforce corporate policy, and DHCP to assign IP addresses. But the cost of each of these services can put them out of a small organization's reach. Sonic Systems has the answer in the SonicWall Plus (\$1,495 list), a turnkey solution that delivers all these features and more in an affordable, easy-to-manage box.

ernet ports on the rear for LAN and Internet connections. All management is done from an intuitive, Java-based browser interface. One minor annoyance: We had to set the IP address of our management PC to the Sonic-Wall's preconfigured IP address to configure the unit. But once you make the connection, you can change the IP address.

For a turnkey solution, the SonicWall includes robust security. NAT capabilities hide the IP addresses of your network clients behind a single IP address, and the

The SonicWall also includes configurable



content filtering. This let us block incoming content, using check-box lists, and let us edit the default lists. We could also make certain users exempt from the filtering. When a user tried to access a forbidden site, we could deny access, create a log, or both. We especially liked the ability to set personalized warning messages for each user.

The Plus version includes intranet capabilities to let you protect LAN resources from local and remote users. We were able to set passwords to access an intranet

server on our test network. This is important if, for example, you want to protect your payroll server.

The device includes notification and HTML-based log files to inform you of errors, policy violations, or intrusion attempts. It can notify you by e-mail in the event of a security breach, but otherwise it simply logs traffic data.

SonicWall Plus. List price: \$1,495. Sonic Systems Inc., Sunnyvale, CA; 800-535-0725, 408-736-1900; www.sonicwall.com. 911 at www.pcmag.com/infolink.

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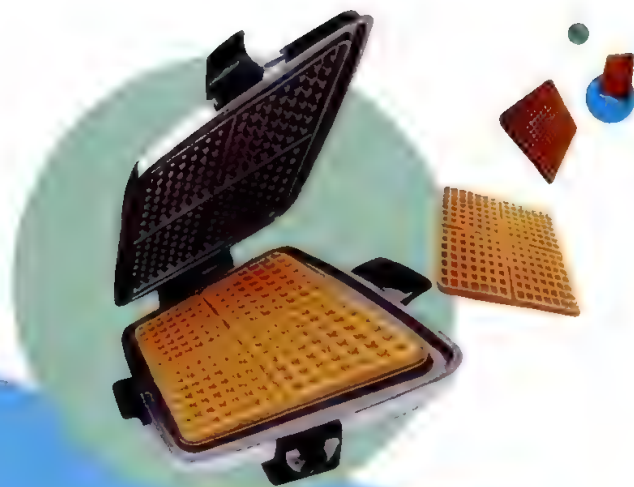
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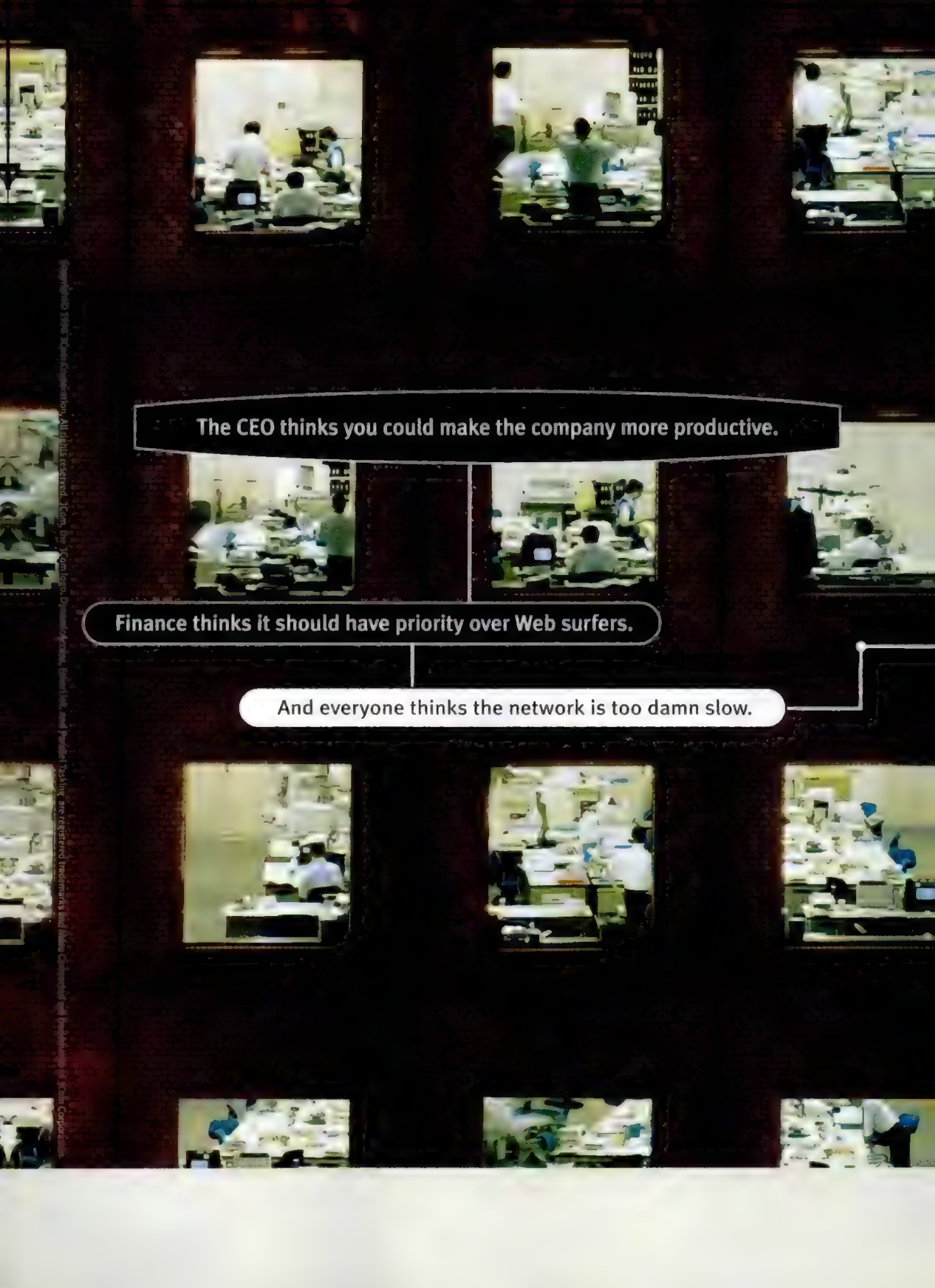


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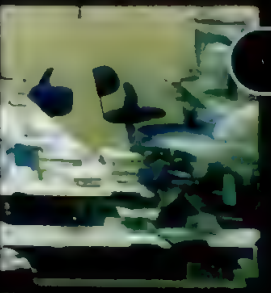
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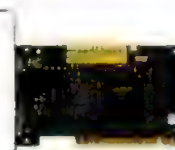
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NETWORK ADMINISTRATION

RAS Doctor

By Steve Rigney

Administrators for an enterprise network's mobile workforce or an Internet service provider can get the most out of their remote-access services with help from Concord Communications' Network Health—Remote Access (\$16,000 list). A module in Concord's Network Health management platform, Remote Access is a unique resource designed to optimize remote-access performance, eliminate downtime, and plan upgrades via a raft of customizable reports.

The Network Health management console runs on Windows NT and Unix. The product is relatively easy to install if you pay close attention to the manual; you're likely to get lost if you skim it. Once the software was installed, we polled the network to discover all our SNMP devices.

Remote Access works with most popular remote-access servers, and it quickly found our Shiva LANRover/E Plus test-bed.

After polling, we chose from three reporting views. The Modem Pool view let us query groups of modems attached to the LANRover and create reports based on the number of calls handled. The RAS view showed us the type of server we had, complete with CPU, network, and chassis information. The Interface view let us create detailed reports on a single modem.

Our favorite feature of Remote Access is the ability to generate trend reports. After running the program for five days, we were able to see which time of day the server was busiest, for example. The trends get more accurate the longer you run the program. These reports are extremely useful in determining if you have enough

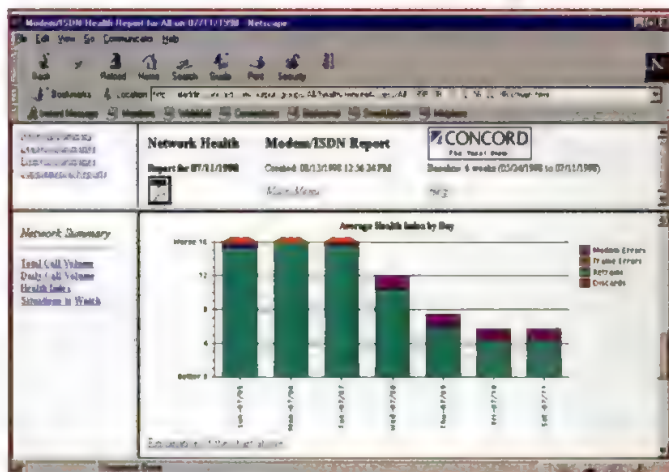


equipment supporting your users.

To generate reports, we simply pointed a browser at the management PC. The default daily report is an at-a-glance view of your remote-access servers, but you can

modify this with a host of options, as well as scheduling the report for different intervals. We suggest generating reports during off-peak hours.

Network Health—Remote Access. List price: \$16,000. Concord Communications Inc., West Marlboro, MA; 508-460-4646; www.concord.com. 912 at www.pcmag.com/infolink. PC



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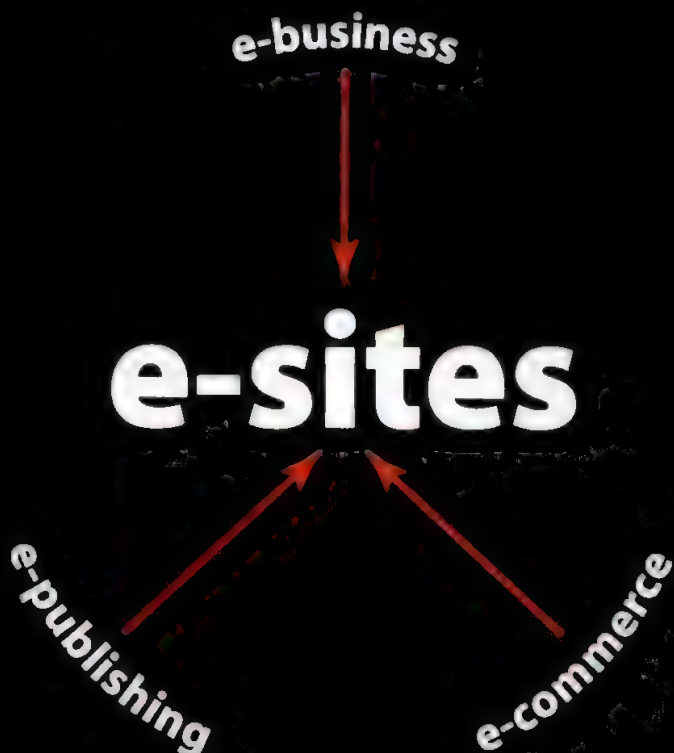
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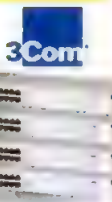
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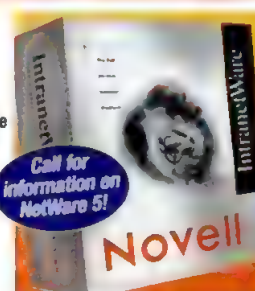


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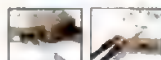
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Life presents many risks, most people seek out the best insurance to reduce the threat of these risks, so why would you trust the protection of your PC to some outlet strip? APC is the world leader in power protection; we provide you with premium, reliable surge protection, and the peace of mind that comes from knowing you have the best protection.

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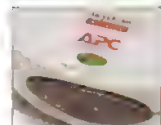


SurgeStation also comes in models with built-in telephone and built-in cable and telephone protection.



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SurgeStation is equipped with a Building/Site Wiring Fault LED that identifies dangerous wiring problems before you plug in your equipment.



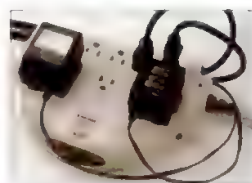
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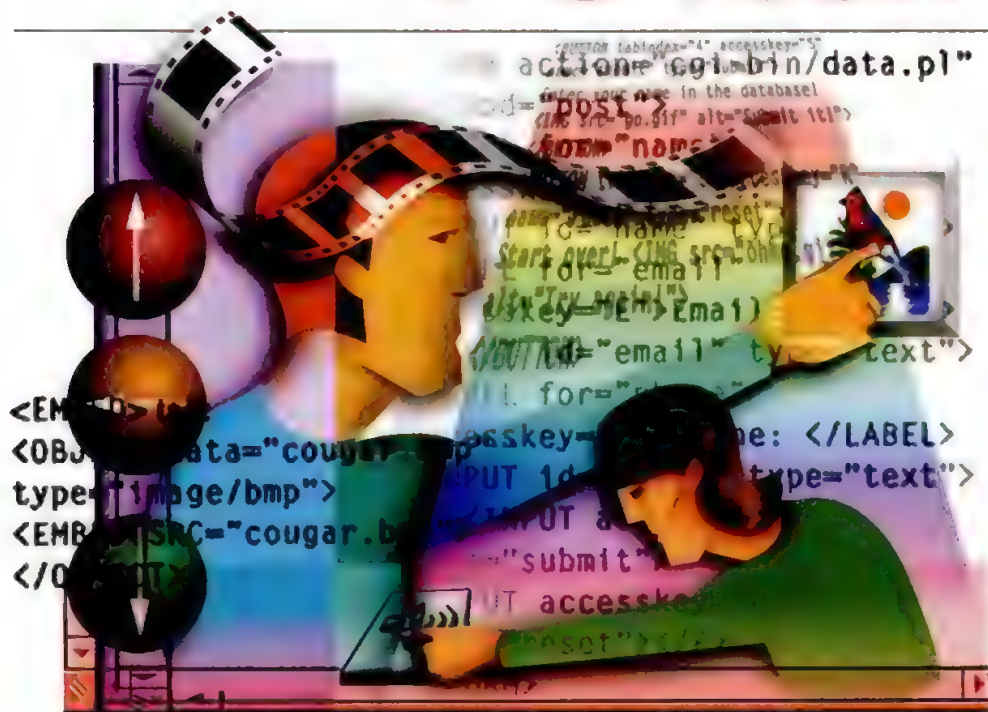
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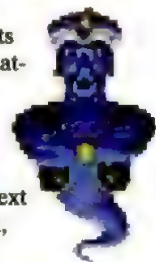


INSIDE

TUTOR: Despite the rigorous usability testing that today's software undergoes, you'd be amazed at how counterintuitive some software features remain. Here are some of the more egregious examples. *Page 255.*

POWER PROGRAMMING:

Speaking of usability, Microsoft's Agent API lets you add animated helpers to your programs. The agents not only display text but can speak, using text-to-speech synthesis, and carry on dialogs for the friendliest user interface possible. *Page 259.*



Essential HTML 4.0

The new specification formalizes some features already supported by current browsers and improves graphics coding.

By William Robert Stanek

Just a few years ago, the Mosaic browser created a sensation with the mere introduction of images for Web pages. Those simple days are long gone. These days, Web pages are increasingly complex and so are the technologies behind them. The HTML 4.0 specification amply demonstrates this: It runs on for a few hundred pages.

As you try to sort through the abundance of features and innovations in the latest version of HTML, you may feel a bit of information overload. Don't worry: Although the changes from HTML 3.2 to HTML 4.0 are significant, many of the new features aren't really new at all. In fact, browsers such as Internet Explorer and Netscape Navigator have supported key features for a while. A number of other new features simplify or enhance existing HTML structures to make working with current Web technologies easier.

Because of limited space,

we'll focus on some of the essentials rather than detailing every new feature. We'll look first at enhancements concerning frames, multimedia, tables, and forms, and then at important changes for working with scripting and style sheets. For more resources on HTML 4.0, go to our Web site, at www.pcmag.com/pctech.

FRAMES

One of the biggest improvements in the latest version of HTML is the specification's recognition of both standard and in-line frames. Frames aren't new, of course. In fact, standard frames were originally introduced by Netscape Navigator 2.0, and various browser versions have introduced enhancements ever since. Fortunately, to be HTML 4.0-compliant, browsers will have to support frames as defined in the specification.

With standard frames, you create Web pages with mini-windows that each contain separate content. Normally, each miniwindow is separated

www.pcmag.com/pctech

You'll find all of the articles, examples, and code files in this section at PC Tech Online.

UTILITIES: Windows has always used the same icon for every folder on your system—until now. Our Folders utility lets you customize icon folders, taking advantage of the Active Desktop feature of Windows 98 and Internet Explorer 4.x. *Page 263.*



PC SOLUTIONS: Delete files and make registry changes at Windows 95 start-up; why a monitor's white can fade to yellow; an Access equivalent for dBASE's SET CARRY ON command; inserting tables into text boxes in Word 97; getting Excel to recognize time values greater than 9,999 hours; and more. *Page 273.*

by a distinct border and displayed with scroll bars. You can also insert a frame directly into a block of text on a Web page, much as you might insert an in-line image. This is known as an in-line frame, and is created using the `iframe` tag. In-line frames have many of the same attributes as standard frames and others have been added for sizing and aligning the frame window.

To use an in-line frame, choose where you want to insert it, and then add the `iframe` element. You specify a source document with the `src` attribute and then size and position the frame. The following example inserts a 500-pixel-high by 325-pixel-wide in-line frame:

```
<iframe src="samples.html"
width="325" height="500"
align="right"></iframe>
```

As with standard frames, you can design the in-line frames without borders using the `frameborder` attribute. You set the attribute value to 1 to display the border or 0 to hide it. To achieve the desired effect, you need to ensure that the contents of the source document fit within the frame. Otherwise, the browser will display a border and scroll bars for the frame.

Note that the `iframe` tag allows you to define information to display in browsers that aren't HTML 4.0-compliant. Just place the information within the `iframe` element like so:

```
<iframe src="samples.html" width="325"
height="500" frameborder="0">
<p>Normally, a product sample is
displayed in this space. However, your
browser doesn't support HTML 4.0.</p>
</iframe>
```

Compliant browsers will ignore text placed like this, while noncompliant browsers will ignore the `iframe` tag and display the information.

One more thing to note about in-line frames: If you name the frame, you can create links that display other files in the frame. The process of directing a hyperlink to a frame is called *targeting*. You target an in-line frame using the value of its name attribute. Simply assign the name as the value of the `target` attribute for the associated hyperlink. Figure 1 shows an example of this. The in-line frame is named *samp*. Three links in the example use this name to target the frame. When you click on a link, the related source file is loaded into the frame.

MULTIMEDIA

Another major step forward is the adoption of the `object` element, which provides a general-purpose tag for working with different types of media such as Java applets, in-line video, streaming audio, and images. Thus it should eventually replace the various

```
<HTML>
<HEAD>
<TITLE>InLine Frames Example</TITLE>
</HEAD>
<BODY BGCOLOR="#FFFFFF">
<DIV>
<H1 align="center">Calculators R Us</H1>
<P><IFRAME name="samp" src="samples.html" width="325"
height="500" align="right" frameborder="0"></IFRAME>
Our catalog features over 500 products that you can
sample online. We invite you to try the product demos
and stay awhile. Today's featured product is 25% off.
See other featured products by selecting them.</P>

<P><A href="feature1.html" target="samp">
S5000 Scientific Plus</A> <BR>
<A href="feature2.html" target="samp">
E2800 Engineering Max</A> <BR>
<A href="feature3.html" target="samp">
M3500 Statistical Plus</A></P>
</DIV>
</BODY>
</HTML>
```

FIGURE 1: Target in-line frames using the name

tags for different media types. Instead of using `applet`, `img`, and `embed`, you'll simply use `object`.

The `object` element can even be used to display text-based files in a browser window, acting in this case much like an in-line frame. Originally, `object` was proposed as a compromise to using tags designed for a specific purpose like `img` and `applet`. Unfortunately, although browser developers saw the need for a standard way to include multimedia in Web pages, they didn't necessarily agree on a way to do this. And so the `object` tag did not become part of the official HTML specification for some time. Finally, with HTML 4.0, the `object` element is being recognized as the solution to the future of embedded multimedia in Web pages.

HTML 4.0-compliant browsers will have no problem interpreting `<object>` tags, but older browsers may not fare so well, and as a result won't know how to display and run your embedded multimedia. For backward compatibility, you may want to insert media-specific tags within the `object` element. Be sure that these tags immediately follow the first `<object>` tag. In the following example, if the browser can't understand the `<object>` tag it will try to use the `<embed>` tag:

```
<object data="cougar.bmp"
type="image/bmp">
<embed src="cougar.bmp">
</object>
```

TABLES

Most of the table innovations in HTML 3.0 remain intact in HTML 4.0, and there are new features as well. You can now group columns together and define column properties at the beginning of the table. You can also define header, footer, and body sections for tables.

You define individual header or data cells with the `th` and `td` elements, and you tell browsers what columns in the table look like using two elements: The `colgroup` tag creates a structural grouping that sets the characteristics of columns within the group, and `col` shares attributes within this structure. Together, these elements allow browsers to start displaying table columns immediately and to build the table incrementally as it is being downloaded.

Using these new elements in a table is easier than you may think. The elements support an identical

set of attributes, which gives you a great degree of freedom in defining group structures. The `width`, `cellhalign`, and `cellvalign` attributes set the default column width, horizontal cell alignment, and vertical cell alignment respectively, and `span` sets the number of columns that share an element's attributes. You can also use attributes for style sheets and intrinsic events to make your tables more dynamic.

To see how these attributes can be used in a table, take a look at Figure 2, in which you'll see several different ways to set the structure for an identical group of columns. Note that if you use relative widths for columns instead of defining absolute widths in pixels, you will need to set the entire table width using the table element's `width` attribute.

You can group table rows into header, footer, and body sections using the `thead`, `tfoot`, and `tbody` elements. The header and footer contain information about the table's columns and the table body contains rows of table data. Ideally, browsers will use this separation to display tables intelligently. For example, if the table extends beyond the current window, the browser could allow the reader to scroll through the body of the table while the header and footer sections



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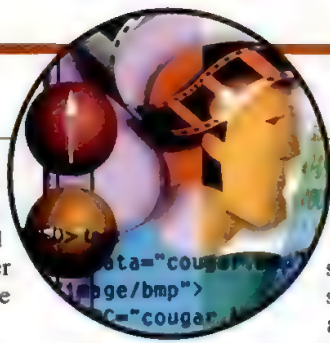


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remain on the screen. Or when a large table is being printed, the browser could include the header and footer sections on each page of the document.

These elements are easy to use. You insert the header and footer sections into the beginning of the table and then define the body sections. Header and footer sections come first so that browsers can display the table even if the body sections are still being retrieved. Figure 3 defines a standard header and footer for a table. Note that the end tags are used for table headers, footers and body sections even though they aren't required in the specification.

FORMS

If you've worked with previous versions of HTML, you know forms haven't change much since they were introduced. This is unfortunate, because forms aren't entirely user-friendly and have needed improvements for a long time. This time around, however, the HTML specification addresses some of the most obvious shortcomings.

There are lots of new features for forms, but let's focus on some of the most useful: tab indexes and access keys. With tab indexes, you can provide a way for users to navigate easily through form fields with a keyboard. You do this by specifying the tabbing order for each element in the form, which makes it possible to use the Tab key to move back and forth through form fields. In the following example, the tabbing order is set sequentially with the `tabindex` attribute.

```
<form action="cgi-bin/data.pl"
method="post">
<p>Name: <input tabindex="1"
type="text" name="userName"></p>
<p>Email: <input tabindex="2"
type="text" name="userEmail"></p>
<p>Phone: <input tabindex="3"
type="text" name="userPhone"></p>
<p><input tabindex="4" type="submit">
<input tabindex="5" type="reset"></p>
</form>
```

When the user presses Tab, the `userName` field will be accessed first, the `userEmail` field next, and so on. The tabbing order can include any number from 0 to 32,767. Browsers use the numerical value to determine the next or previous field.

Forms have needed improvement for a long time. HTML 4 addresses the shortcomings.

access key for an input field in some unique way, such as with underlined or bold text. You can assign the access key to a form field directly using the `accesskey` attribute, but you can help the browser better determine how to render the access key by labeling your input fields and assigning the access key to the label. Labels are new to HTML 4.0. When you label a form field, you attach information to the field. Labels use a `for` attribute to identify

```
//Setting the width of each column individually
<COLGROUP>
<COL width="100">
<COL width="100">
<COL width="100">
<COL width="75">
<COL width="75">
<COL width="75">
</COLGROUP>

//Using spans to make the code more compact
<COLGROUP>
<COL span="3" width="100">
<COL span="3" width="75">
</COLGROUP>

//Assigning the column width and span directly
to the column groups
<COLGROUP span="3" width="100">
</COLGROUP>
<COLGROUP span="3" width="75">
</COLGROUP>
```

FIGURE 2: Using the COLGROUP and COL elements.

fy the related form field. The value of this attribute must correspond to the value of an `id` attribute in the related field. The following sample uses labels with text input fields:

```
<form action="cgi-bin/data.pl"
method="post">
<label for="name" accesskey="N">Name:
```

Form fields can also be assigned an *access key*. Access keys let you use keyboard shortcuts for quick access to a specific field in a form. For example, if you assigned the N key to the `userName` field in the previous example, you would be able to use this key to go directly to the field. The way access keys work depends on the operating system you are running. On Microsoft Windows systems, you typically press the Alt key in addition to the access key. Thus, to access the `userName` field on a Windows system, you'd press Alt-N.

Browsers should display the access key for an input field in some unique way, such as with underlined or bold text. You can assign the access key to a form field directly using the `accesskey` attribute, but you can help the browser better determine how to render the access key by labeling your input fields and assigning the access key to the label. Labels are new to HTML 4.0. When you label a form field, you attach information to the field. Labels use a `for` attribute to identify

```
</label>
<input id="name" type="text">
<label for="email"
accesskey="E">Email: </label>
<input id="email" type="text">
<label for="phone"
accesskey="P">Phone: </label>
<input id="phone" type="text">
<p><input accesskey="S" type="submit">
<input accesskey="R" type="reset"></p>
</form>
```

Another useful form enhancement is the button element. This element creates a push button, much like the *Reset* and *Submit* buttons used in forms. However, you can add content to these new buttons (something you couldn't do with standard push buttons), so your new buttons can contain images, paragraphs of text, and other extras.

To add these extras, all you need to do is insert them between the opening `<button>` tag and the closing `</button>` tag. Thus, you could replace the standard *Submit* and *Reset* buttons used in a previous example with button elements. To make these elements stand out, you could add text and images, such as

```
...
<button tabindex="4"
accesskey="S" name="submit"
type="submit">
Enter your name in the
database! 
</button>
<button tabindex="5"
accesskey="R" name="reset"
type="reset">
Start over! 
</button>
```

Don't forget that older browsers may not be able to use the button element. Instead of a push button, you'll see only the button's contents. A workaround is to place submit and reset fields within the button element, such as

```
<button name="submit"
type="submit">
<input type="submit"></button>
<button name="reset" type="reset">
<input type="reset"></button>
```

SCRIPTING

Scripting is the key to interactivity on the Web. Until recently, however, scripting mech-

anisms weren't well defined in the HTML specification, leading to a lot of inconsistency in how browsers handled scripts. The good news is that HTML 4.0 takes a more thorough approach.

One of the most important changes involves how you specify scripts in your Web pages. With the `meta` element, you can now define a default scripting language for all scripts in a page. You do this by specifying a value for the `Content-Script-Type` HTTP header. If you do not assign a default value in a `<meta>` tag, the browser can try to extract this value from the associated field in the actual HTTP header sent by the Web server.

When you set a default scripting language, you use the MIME content type for scripts. Most often, the MIME content type will be either `text/vbscript` for VBScript or `text/javascript` for JavaScript, but other valid content types can be used, such as `text/tcl` for TCL. To set the default scripting language to JavaScript, you'd use

```
<meta http-equiv="Content-Script-Type"
content="text/javascript">
```

You can override the default scripting language at any point in your pages with the `script` element, but note that the specification no longer recommends that you use the `language` attribute with it. Instead, the HTML specification recommends that you use the `type` attribute, which lets you specify the MIME content-type for your scripts, for example `<script type="text/vbscript">`. But watch out: If you use the `type` attribute, some older browsers may not be able to handle your scripts properly. While all this gets sorted out, it is probably a good idea to know that the `type` attribute is valid but doesn't have to be used just yet.

Another important change for Web scripting is that most HTML elements now support a wide range of event attributes. Events occur automatically when a certain condition exists. Some events are user-driven, by the press of a key or a click of the mouse. Others are browser-driven, such as when the browser finishes loading an image. Event attributes allow you to specify the conditions you want an element to detect. For example, you can create clickable cells in tables, paragraphs of text that light up when the mouse is over them, and a whole lot more.

There are several ways to work with events. You can use event attributes, such as `onclick` or `onkeypress`, to detect the event and then pass it off to a script function. On the other hand, if you want to check for a specific event within your code, you can create a function to

detect and handle the event directly. The following example shows how you could use the `onmouseover` event attribute with the `<a>` tag:

```
<a href="main.html"
onmouseover="show('Visit our home
page')">Main</a>
```

When the mouse pointer is over the anchor text, the `show()` function is called and passed the associated text. As you'll discover, the best time to use event attributes in this way is when you want to use the same function over and over.

Anytime you use events specific to HTML 4.0, it is a good idea to test your page in a non-compliant browser. Generally, these browsers ignore event attributes they don't understand, and as a result the functionality you expect won't be supported. If you plan your Web page with this in mind, you should be able to avoid problems.

```
<TABLE BORDER=2 WIDTH=50%>
<COLGROUP>
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</THEAD>
<TFOOT>
  <TR><TD>Company data provided for statistical purposes only.</TD></TR>
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<TBODY>
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  <TR> <TH>Week 2</TH> <TD>194</TD> <TD>197</TD> <TD>205</TD> </TR>
  <TR> <TH>Week 3</TH> <TD>212</TD> <TD>225</TD> <TD>234</TD> </TR>
  <TR> <TH>Week 4</TH> <TD>145</TD> <TD>176</TD> <TD>179</TD> </TR>
  <TR> <TH>Week 5</TH> <TD>167</TD> <TD>182</TD> <TD>193</TD> </TR>
  <TR> <TH>Week 6</TH> <TD>185</TD> <TD>201</TD> <TD>205</TD> </TR>
  <TR> <TH>Week 7</TH> <TD>197</TD> <TD>207</TD> <TD>213</TD> </TR>
  . . .
  <TR> <TH>Week 52</TH> <TD>203</TD> <TD>221</TD> <TD>279</TD> </TR>
</TBODY>
</TABLE>
```

FIGURE 3: Use headers and footers to help the browser structure the table.

STYLE SHEETS

When you want to create attractive Web pages, you'll find that cascading style sheets provide the necessary ammunition. Style sheets let you control the color of text and backgrounds, the positioning of content, and many other crowd-pleasing extras. Before style sheets came along, Web publishers had to rely on existing HTML structures to control the look and feel of their Web pages. If you wanted to change a page's background color, you used the `bgcolor` attribute of the `body` element. If you wanted to center text

on the page, you used the `center` element, and so on.

Unfortunately, when you mix a document's presentation information with its content, you create a document that is unnecessarily complex and difficult to maintain. Because style sheets offer a way to separate the presentation of documents from the actual content, there is a major initiative to phase out most of the presentation elements and attributes from HTML. This means that many of the elements and attributes you've been using in your Web pages may eventually go the way of the dinosaur. Keep in mind, however, that change takes time; it will likely be a while before these elements and attributes are completely removed.

Elements and attributes that are in danger of being dropped from the HTML specification are designated as *deprecated* (disapproved for use). One of the elements many Web publishers will miss is `font`, which is used

to specify text color, font face, and font size. Other elements on the chopping block include: `basefont`, which is used to set default font information; `center`, used to center elements on the page; and a few other elements such as `u` for underlining and `s` for strikethrough text.

In addition to placing elements on the disapproved list, the specification declares some elements obsolete and others as not recommended for use. Obsolete elements are no longer listed in the HTML specification and there is no guarantee a browser will support

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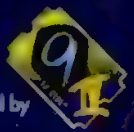
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Usability Gaffes: Things That Make You Go Arrrrgh!

Even some of the best-designed programs can have usability shortcomings that leave users scratching their heads.

By Neil Randall

Last issue, we looked at how usability tests are conducted, and we briefly touched on how specific features in certain Microsoft products have undergone changes as a result of usability testing. This time we'll look at some usability problems in a variety of software products as a means of demonstrating the kinds of problems that usability testing should have caught or should catch for future releases. None of these examples are obscure; each is apparent to anyone using the software with any degree of frequency. As a whole, they represent the kinds of problems that make us all wonder how anyone could have let such glaring usability glitches get through the final release.

All of these examples are simply observations and not the results of formal testing in any way. But the ultimate usability test is conducted by the buyers and users of the software. As any developer knows, no amount of testing of any kind will reveal as many issues as simply having the software on the market for a month. Users will find things developers never imagined.

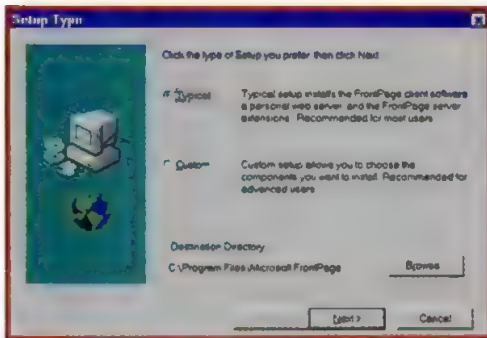


FIGURE 1: The installation dialog from Microsoft FrontPage 98 offers only minimal information, forcing users to guess at the right choice.

When reading these examples, it's important to keep in mind that usability issues should not be confused with technical issues. A feature might work as well as possible from a technical standpoint but still be less friendly than it could be or should be. We're not concerned, in other words, with technical possibility; we're only concerned with whether the thing is efficient to

use. At the same time, we must judge features according to what they were designed to do, not as our fancy might remake them. Usability testing isn't about discovering missing features but rather discovering issues with using existing features. Let's take a look at some common usability problems.

INSTALLING PROGRAMS

Installing a program in Microsoft Windows 95, 98, or NT is quite easy. Simply put the disk in the CD-ROM drive and wait for the installation dialogs to appear. Or if that's not possible, find the Setup.exe file for the package and launch it. But significant usability issues present themselves once you've started. First, the dialog (shown in Figure 1) typically asks you what type of installation you want: *Typical* or *Custom* (sometimes offering more choices such as *Complete* and *Minimal*). The dialog box tells you a tiny bit about the implications of each type—*Minimal* is for notebook installations, for example—but not nearly enough. Even experienced users want to know, without choosing *Custom*, how many more selections they'll be expected to make, and how much of the program they don't install if they select *Typical* or *Minimal*. Simply showing the difference in required disk space isn't sufficient.

This is a crucial part of the process, because there's a very good chance that selecting *Typical* or *Minimal* will result in a novice user never knowing all the available features or an experienced user spending far more time than necessary. All that's required, from a usability standpoint, is a button labeled *Details*. When clicked, this button would yield an explanation of what each installation type does and does not do. Ideally there would be explanations for novice, intermediate, and experienced users. Figure 2 presents a real-world example of a dialog with a *Details* button.

Some usability issues occur during the installation process, but the most unnerving appears at the end. Normally, the last thing that happens is that a folder containing the program's icons will open automatically, ready for action. Even here there should be an explana-

tion for novice users, reminding them how to access the program in the future (*Start | Programs | etc.*). Many programs do something much worse: They tell us to restart Windows for the installation to be complete.

Now there are technical reasons for the restart; primarily it allows Windows to load the dynamic link libraries (DLLs) needed to run the program. But if you're running multiple programs, you're connected to your Internet provider, and you have three or four browser windows open with essential research information, this request is intrusive in the extreme. Restarting Windows means shutting all these programs down and then starting them up again after reboot, and who knows if you can even get a line into your ISP at that point, let alone get your screen set up exactly as you had it?

Netscape Communicator installs this way, as

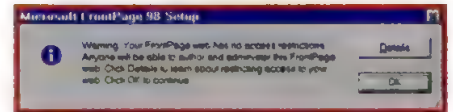


FIGURE 2: This dialog from FrontPage 98 offers a *Details* button that opens a text document explaining what happens next.

do many other programs, but the worst offender is Microsoft itself. Install almost anything from Microsoft and you'll have to restart Windows—nothing less than a usability failure. To be sure, install programs always warn the user to shut down all programs before installing the new one, but that too is an intrusion. Many of us have installed new packages without exiting all running programs or having to restart, so the whole procedure is questionable.

PROGRAMS THAT TAKE OVER THE FOREGROUND

Windows is a multitasking environment, but its multitasking behavior is often nothing short of rude. Let's say you have two programs running, and you're working in program A while program B runs in the background. If program B does something that requires your attention, there's a very good chance it will become the active program, effectively kicking you out of program A. This can be disastrous, especially if the newly active program offers a dialog box that requires a press of the Enter key to do something you don't want it to do. If you're touch-typing when this dialog takes over the foreground, you can perform actions without even realizing it.

The problem also occurs when you launch program B while working in program A. For example, let's say your ISP connection requires you to type in your user name and password in a separate log-on window. You launch

Dial-Up Networking; then, while dialing your ISP, you launch your browser. Before the browser is finished loading, the log-on win-

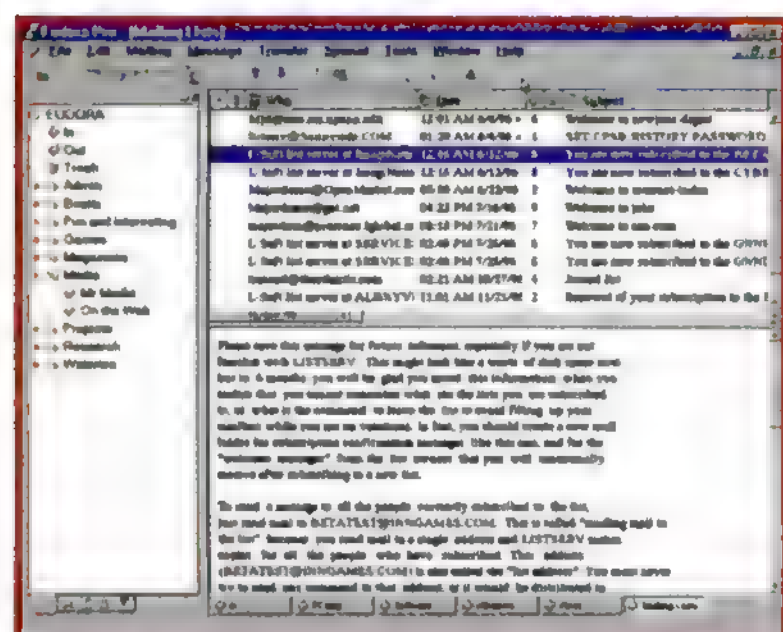


FIGURE 3: Eudora Pro's three-pane view, with the message pane at top right and preview pane at bottom right.

dow appears and becomes the active window. If you start typing your account information, you can be almost certain that your browser (especially Microsoft Internet Explorer) will make itself active once or even twice as it loads, kicking you out of the log-on window. You have to keep switching back and forth, and that's simply unusable.

One solution is to force an application to remain in the background unless there's a pause in input activity for a certain time (even 2 seconds)—the program can take over at that point. As it stands, it's a frustrating experience.

PROGRAMS WITH CONFUSING INTERFACE ACTIONS

This is too broad a category to deal with in detail, so we'll simply look at the way a specific interface is handled in three similar programs. Microsoft Outlook 98, Eudora Pro Email 4.0, and Calypso E-mail 2.4 are all e-mail packages that feature a three-pane window. By default, the folder list appears down the left side, the basic message headers appear in the top-right pane, and the message itself displays in the preview pane at bottom right (see Figure 3).

All three programs present a simple usability difficulty that relates to the preview pane. When you click on a header in the message pane, several lines of the message appear in the preview pane. To see the remaining lines, you must either use the preview pane's vertical scroll bar or click in the preview pane and use the Arrow, PgUp, and PgDn keys. All this is fine. The difficulty is that the method of deleting a message

changes depending on whether the message pane or the preview pane is currently active.

When you click on a header in the message pane in any of the three programs, the message pane becomes active, and you can press the Delete key to delete the message. But the Delete key functions differently, or not at all, if the preview pane is active. In all three programs, if you click in the body of the preview pane, Delete will no longer do anything. In Outlook 98, the Delete key will still delete the current message as long as you scroll with the preview pane's vertical scroll bar but not if you click inside the body. In Outlook 98 and Eudora Pro, Ctrl-D deletes the message in such a case, although in Calypso you simply can't delete the message from within the preview pane. The purpose of these examples isn't to declare one package more usable than another in this regard, but to suggest that all have usability problems here. Deleting a message should be simple and consistent across the two panes.

Another usability point creeps in here in Eudora Pro. If you select a header in the message pane, the program will automatically make the preview pane active and route subsequent keystrokes to it. In one way this makes sense, because presumably you want to read the message all the way through, and you might need to scroll down to do so. But this technique is clumsy because it eliminates the ability to use the arrow keys to scroll through the list of message headers, something that eases the use of a folder with many messages.

As in all usability cases discussed here, these are problems that aren't devastating. You can find ways to work with them, and after a while you simply adjust. But the question for usability testers is how effective, efficient, and easy to use a feature is; the action of

the Delete key and the active status of panes affect daily use of the package. Many other usability issues become apparent as you work through all three packages, but this little one

demonstrates how a small thing can affect usability significantly.

PARALYZING DIALOG BOXES

Dialog boxes must be well designed to be usable. Here, *well designed* means that the choices being offered are clear and that the user isn't confused about which choice to make. In

fact, it's especially important that the user isn't afraid to make a choice. With either reaction, the user could experience a temporary paralysis, not knowing which button to click. Below are two dialog boxes which we'll examine from a usability perspective.

The alert shown in Figure 4 occurs in Microsoft Word 97 if the filename you specify in the Save dialog already exists in the current folder. The dialog asks whether you want to replace the existing document of the same name; your choices are *Yes*, *No*, and *Cancel*. Right off the bat there's a problem, because an inexperienced user won't necessarily know what replacing a document will actually do. The dialog would be more usable if it explained that replacing a document means the original will no longer exist (except in the case of automatic backups, but that's a different issue).

The major usability concern here, though, has to do with what happens in the case of *No* and *Cancel*. It's not apparent from the dialog, nor from simple logic, how the two choices differ. A novice user faced with this dialog could easily mistake the two, and click on *No* rather than *Cancel*. Again, this is only a problem for people who don't know the program, but a short explanation would help immensely.

Figure 5 shows the result of a relatively unusual event using In-

ternet Explorer 4. If you go to a site where your actions post data to a form and then click on the *Refresh* icon to update that page, you'll be asked the question *Repost form data?*, to which you can answer *Yes* or *No*. The problem, of course, is that most users simply won't know what the question means. Users who have designed a form-based Web site will probably understand the concept, but there's no reason anyone else would. The dialog doesn't suggest what will happen if you select *Yes* or *No*. It's potentially paralyzing, even for a fairly experienced Web user.

YOUR TURN

Undoubtedly, you have your own examples of usability gaffes, drawn from your computing experience. On *PC Magazine's* Web site (www.pcmag.com) you'll find a feedback form that lets you post them for all to see. As we collect them, we'll forward them to the producers of the software. Please restrict your comments to specific usability issues with specific software. And be specific; your comments just might make a difference.

Neil Randall is the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage 98 (Que)*.

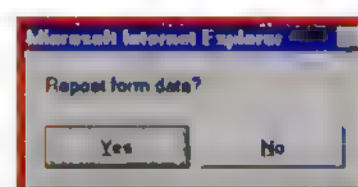


FIGURE 5: Internet Explorer 4 presents this dialog when you refresh a form.

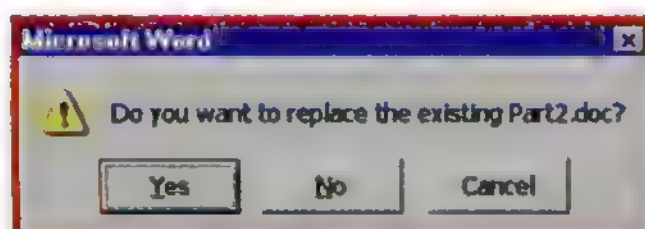
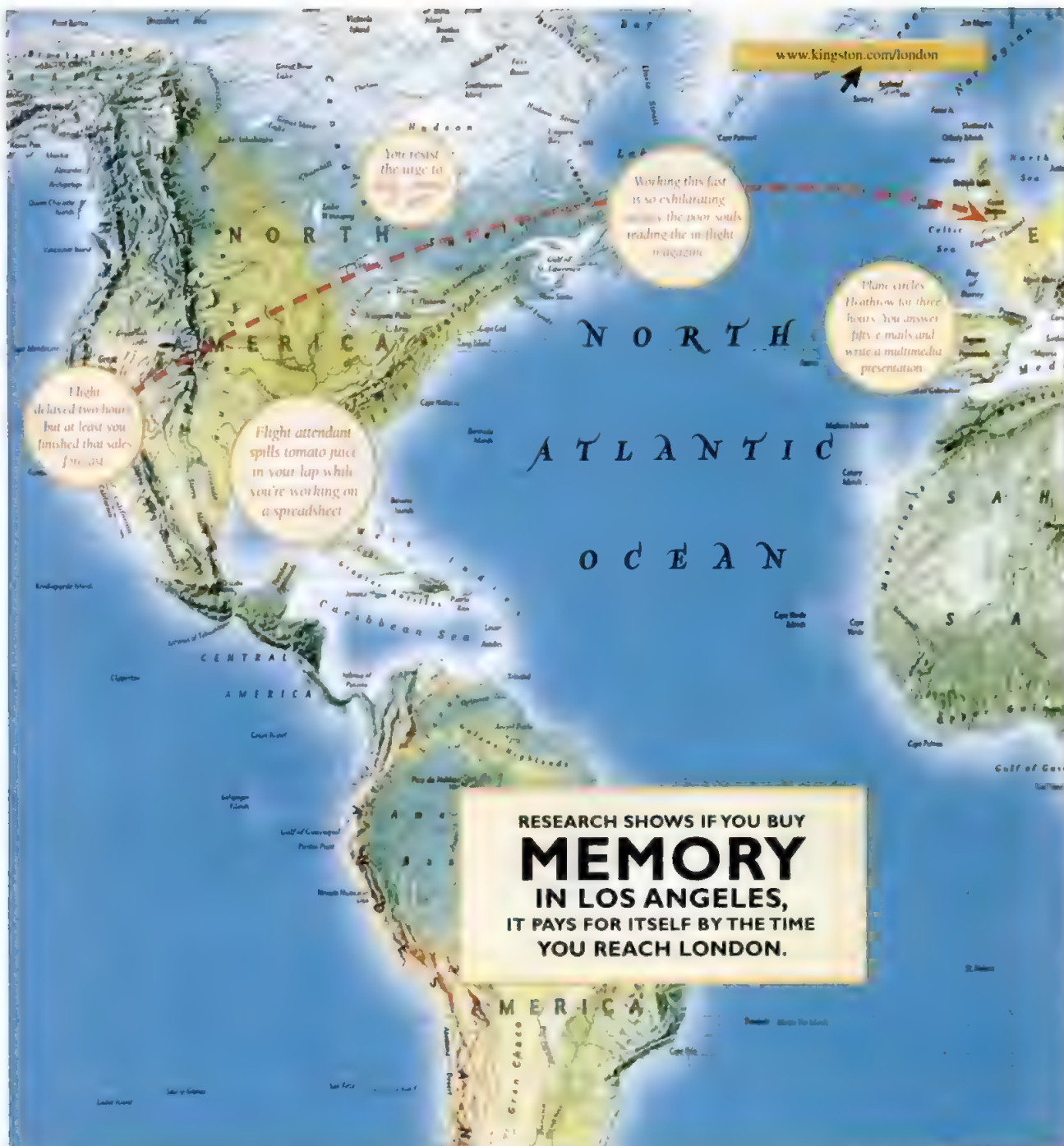


FIGURE 4: Microsoft Word 97 gives you a choice in its Save As dialog.



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Give Your App an Assistant With the Agent SDK

The Microsoft Agent SDK lets you add animated helpers.

By John Lam

Our users are a spoiled lot. They clamor for easier-to-use applications, yet they demand more and more features. As developers who have to ship software under increasingly tighter schedules, we have to make compromises. Inevitably, we end up trading ease of use for additional features.

How do we try to make our applications easier to use? Often, developers just copy Microsoft. Each release of a major Microsoft application adds new UI innovations that can improve ease of use. Unfortunately, in the rush to be "Microsoft-compliant," these designs inevitably become the year's fashion statement for end user applications.

Of the design innovations introduced by Microsoft, none has the potential to improve ease of use as much as the Office Assistant, the animated paper clip introduced in Office 97. It provides a *conversational* interface to applications, offering users an alternative to menus, toolbars, and mouse operations. Users can ask the Assistant questions, and the Assistant can respond with hints or step-by-step instructions, or it can even perform the desired operation directly for the user.

The Office Assistant technology—which has largely been superseded by the Microsoft Agent technology, which we will explore in this article—has its roots in a failed Microsoft product: Bob. Microsoft Bob attempted to make "social" interfaces ubiquitous within the operating-system shell, but Microsoft didn't realize that such an interface would be too intrusive for most sophisticated users. Drawing from this experience, you should use the Agent technology sparingly within your user interfaces. Always provide a conventional mechanism (such as a menu and a toolbar) through which users can interact with your application.

THE MICROSOFT AGENT SDK

Until recently, software developers who wanted Assistant-like features in their applications had two choices: create their own Assistants

from scratch or require that their users have Office installed on their computers. With the release of the Agent SDK, however, developers now have a set of system services that can add animated characters to applications. Please consult the Agent SDK license agreement for specific details on the redistribution rights.

The Agent SDK picks up where the Office Assistant left off, and it adds both voice response and speech synthesis. You can get your copy of the Agent SDK from Microsoft's Agent page at www.microsoft.com/workshop/c-frame.htm#/workshop/imedia/agent/default.asp. Make sure that you install this SDK before you attempt any of the samples in this article.

The Agent SDK consists of three primary components. First, there are the ActiveX control that contains the code for Agent; TruVoice,

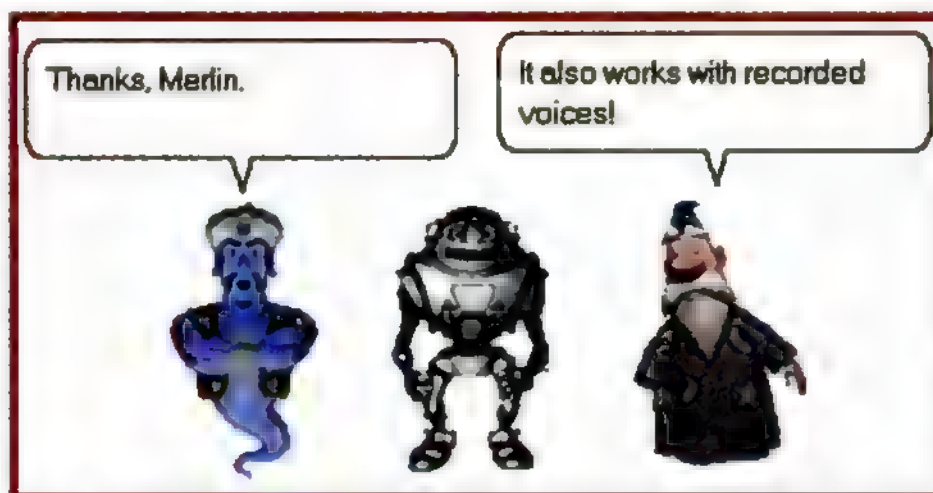


FIGURE 1: *The Genie, Robby, and Merlin, Microsoft's sample Agents, engage in a tutorial dialogue.*

the Lernout & Haspie text-to-speech engine; and the Command and Control Speech Engine. There are three animated characters that you can use in your own applications: Merlin the Wizard, Robby the Robot, and the Genie (see Figure 1). Finally, the Agent Animation Editor lets you create your own.

In this article, I'll be focusing on programming issues only. I'll leave the creative elements to those who are more artistically adept.

THE ACTIVEX CONTROL

The Agent ActiveX control exposes Agent's application programming interface (API) through a Component Object Model (COM) dual interface. (For a discussion of dual interfaces, see "Dual Interfaces Using Delphi" in the Power Programming column of November 5, 1996.) You can use any COM-friendly tool

(C++ Builder, Delphi, Visual Basic, Visual C++, or Visual J++) to program Agent. You can also manipulate the Agent control from an Active Scripting environment, such as Internet Explorer 3.0 or 4.0 or the Windows Scripting Host.

In this article, we'll present some simple JScript code that allows you to manipulate Agent characters from within Internet Explorer 4.0 Dynamic HTML pages. For your downloading pleasure, I will build compiled executables using Delphi 3.0, Visual Basic 5.0, Visual C++ 5.0, and Visual J++ 6.0 to illustrate how one can use and manipulate Agent characters from different programming languages. You can download the sample code from the *PC Magazine* Web site (www.pcmag.com/pctech) or from my Web site (www.iunknown.com).

Before you can use Agent, you must first acquire a reference to this interface. Adding the following <object> tag to an HTML page easily does this:

```
<object classid="clsid:F5BE8BD2-7DE6-11D0-91FE-00C04FD701A5" id=Agent>
</object>
```

The id attribute of the <object> tag above serves as our reference to Agent's COM interface. By manipulating this reference, you can select characters for your user interface. The control is capable of manipulating more than one character at a time, so you need to assign each character a unique reference in your application code.

Before you can manipulate an Agent animated character, you must first inform the Agent ActiveX control of the location of the file that defines that character. This is done by the following sequence of JScript code:

```
var robbly;
Agent.characters.load( "Robby",
"http://www.microsoft.com/workshop/imedia/agent/robbly.acs" );
robbly = Agent.characters( "Robby" );
```

In this case, we have just added a reference to the animation file for Robby the Robot to the Agent ActiveX control. We have declared a local variable called robbly that we will be using to manipulate our character, and we have assigned it to the Robby character reference maintained by the Agent ActiveX control.

Once you have a reference to the character, you can move him around, you can tell him to say a phrase, and you can get him to play predefined animation sequences. The example below instructs Robby to appear on the screen, fly to (300,300) on the screen, and play the standard greeting animation:


```
robby.Show();
robby.MoveTo(300,300);
robby.Play("Greet");
```

The `Play()` method allows you to specify what kind of animation you would like your character to play. The standard characters included in the Microsoft Agent SDK have a number of predefined animations. A small subset of the more than 80 animations supported by the Robby character is listed in Figure 2.

When Robby is not actively engaged in displaying an animation that you have specified, he goes into an idle mode. While in this mode, he is free to play any number of predetermined idle-time animations. Let Robby hang around on your screen for a while, and be prepared for some entertainment!

Robby can do more than just play predefined animations and move about the screen. He can also speak to the user and accept voice commands. To instruct Robby to say a phrase, you can call Robby's `Speak()` method and pass along the phrase that you would like

to calculate these coordinates, fortunately the calculation is not particularly difficult:

```
function JavaMoveToObject( theObject,
strGesture, strMessage )
{
    var x, y;
    x = window.event.screenX -
        window.event.x +
        theObject.offsetLeft;
    y = window.event.screenY -
        window.event.y +
        aButton.offsetTop
    robby.moveTo( x +
        theObject.offsetWidth, y );
    robby.play( strGesture );
    robby.speak( strMessage );
}
```

The `JavaMoveToObject` method instructs Robby to move to the right of the object specified by the `theObject` reference, play the animation specified by `strGesture`, and speak the phrase indicated by `strMessage`. The reason

for the somewhat nonintuitive calculation of the *x*- and *y*-coordinates is that there's no function in IE4 that can retrieve the screen coordinates of the top-left corner of the IE4 window. We must instead rely on the coordinates of the last event fired in IE4 to determine the coordinates of the top-left corner.

DUELING AGENTS

An especially effective technique for instructing users on how to use a

given feature in your application is to have two characters carry on a conversation. The first character asks the second how to invoke a feature, and the second character shows the steps involved. During the monologue by the second character, the first character can interact with questions to clarify particular points.

However, the speech engine used by Agent will allow only one character to speak at any one time. Unfortunately, the `Speak()` method, which we use to instruct the character to speak, is not synchronous. That is, the call to `Speak()` returns immediately and does not wait until the character has finished speaking. To compound matters, the speech engine can be interrupted at any point in time by another character that wants to speak.

For two characters to carry on a conversation, they need to speak in a synchronous manner. We must allow the first character to finish speaking before we let the second character start chiming in with his two cents worth. The `Wait` method allows us to wait for a character to finish speaking before the next char-

acter begins. Here's an example of how we can have two characters (Robby and Merlin) carry on a conversation:

```
var robby;
var merlin;
var waitRobby;
Agent.characters.load("robby",
"http://www.microsoft.com/workshop/
imedia/agent/robby.acs");
Agent.characters.load("merlin",
"http://www.microsoft.com/workshop/
imedia/agent/merlin.acs");
robby = Agent.characters("robby");
merlin = Agent.characters("merlin");
robby.Show();
merlin.Show();
waitRobby = robby.Speak("Hi! I'm
Robby the Robot. I'd like to introduce
my friend Merlin the wizard.");
merlin.Wait( waitRobby );
merlin.Speak("Hi Robby, I'm Merlin
the Wizard!");
```

The call to the `Wait` method causes execution to pause at that line of code until Robby has finished speaking.

WRAPPING THINGS UP

In this article, I have presented some simple JavaScript code that allows you to manipulate Agent characters from within an Internet Explorer 4.0 Web page. If you download the accompanying source code, you'll see how you can manipulate Agent from several development tools that support COM: Delphi 3.0, Visual Basic 5.0, Visual C++ 5.0, or Visual J++ 6.0.

Definitely consider using Microsoft Agent in your own applications. Agent allows you to build a nonintimidating user interface that can be very useful for first-time users of your application. Keep in mind, however, that users typically progress rapidly and may find your character annoying once they become familiar with your application. Remember to give users a choice of turning off your animated character!

FURTHER READING

For more on the Microsoft Agent programming model, *Programming Microsoft Agent* (Microsoft Press, 1998; ISBN=1-57231-720-5) contains a hard copy of the documentation provided by the Agent SDK in HTML format.

You can also find a number of useful samples on the Microsoft Agent site: www.microsoft.com/workshop/cframe.htm#workshop/imedia/agent/default.asp. 

John Lam recently published *Essential Web Applications*, the latest developer course from DevelopMentor (www.develop.com).

AGENT ANIMATIONS

Animation	Description
Acknowledge	Nods head.
Congratulate	Raises hands, clasps them, and smiles.
CongratulateReturn	Returns to neutral position.
GestureRight	Gestures to his right.
Read	Tears off printout, reads, and looks up.
Sad	Makes sad expression.
Think	Tilts head and scratches it.
Wave	Waves.

FIGURE 2: Here are just a few of Robby's actions.

Robby to say. If you want Robby to select from one of several phrases randomly, just separate adjacent phrases with a vertical bar (`|`):

```
robby.Speak( "Hello world!|Good
morning!" );
```

SCREEN COORDINATES

You must specify Robby's location through absolute screen coordinates. This provides the maximum flexibility, as this coordinate system does not constrain Robby to the confines of his parent application's main frame window. Unfortunately, this also adds a small amount of complexity to your Agent-based applications.

The coordinates of all elements in an HTML page are specified relative to the top-left corner of the Internet Explorer window displaying your page. In order to move Robby to the left of a control on your HTML page, you'll have to translate the coordinates of that control from the relative coordinates that Internet Explorer provides into the absolute coordinates that Robby needs. While you do have

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Assign Custom Icons to Windows Explorer Folders

Liberate your system from Windows' insistence on using the same icon for all folders.

By Neil J. Rubenking

Next to every file's name, Windows Explorer displays a handy icon that identifies that file's type. Folders, though, get no such individual treatment. All ordinary file folders are represented in Explorer by the same bland icon. It's even possible to give every file of a given type its own individual icon, using something called an *icon-handler shell extension*. Here again, though, folders get short shrift: Icon-handler shell extensions don't work with folders.

There is hope, however. Active Desktop, installed as part of Windows 98 and as an option with Internet Explorer 4, supports a new technique for assigning folder-specific custom icons. Internally, this technique is used for such purposes as marking the folders that represent Internet channels with channel-specific icons. *PC Magazine's Folders* utility (see Figure 1) exposes the same technique for your own personal use. *Folders* works only on systems that have Active Desktop installed, which includes all Windows 98 systems; Windows 95 or NT 4.0 users can install Active Desktop as an option when installing Internet Explorer 4.x.

You can obtain *Folders* by free download from PC Magazine Online (www.pcmag.com/pctech) or by mail. Refer to the sidebar "How to Get the Files" for details. The Delphi 3 source code for *Folders* is also provided for those interested in seeing how it works.

USING FOLDERS

To install *Folders*, run its installation utility, *Install.exe*. The install program for *Folders* places the program's files in your Windows folder rather than creating a new folder, and it doesn't add anything to the *Start* menu. But

when you right-click on a folder, you'll see a new item titled *Folders—Change Icon...* on the pop-up menu, as shown in Figure 1. Select this menu item to bring up the main *Folders* window (see Figure 2). This window provides a view of the current folder's custom icon, if there is one, and permits you to choose a new custom icon or remove an existing one.

Clicking the *Choose Icon...* button brings up a standard Windows icon-selection dialog box (see Figure 3). If the folder already has a

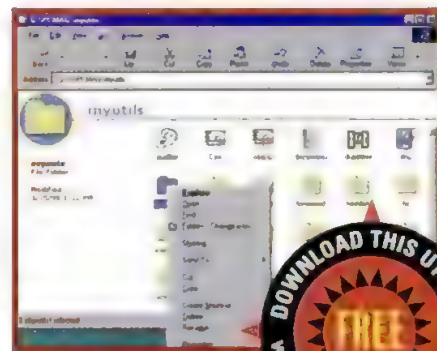


FIGURE 1: The *Folders* menu item appears when you right-click a folder. Here, the folders in the first row have already been given individual icons.

custom icon, the icon will be highlighted in the dialog box. Otherwise, the standard folder icon, found in *Shell32.dll*, will be highlighted. You can choose any of the icons from *Shell32.dll*, or click *Browse...* to pick a different file. Other sources of standard icons are *Pifmgr.dll*, *Moricons.dll*, and *Progman.exe*. *Shell32.dll* and *Pifmgr.dll* normally reside in the Windows System folder, and *Moricons.dll* and *Progman.exe* are normally found in the Windows folder. Of course, you can choose

any other EXE, DLL, or ICO file. Don't be confused by the wording of the *Files of type* list in this dialog box. *Icon Files* means any of the three types, while *Programs*, *Libraries*, and *Icons* correspond to EXE, DLL, and ICO files.

When you choose an ICO file, *Folders* will make a hidden copy of the file in the current folder. A custom icon that uses an ICO file stored in the folder itself will remain in effect even when you move the folder to a different node in your network.

When you assign a custom icon to a particular folder, Windows Explorer might not immediately display the new icon in all locations. For example, it might show the new icon in the right-hand pane but not in the left-hand pane, or vice versa. In most cases, selecting the instance that failed to change and pressing F5 will alert Explorer to the change. If not, the new icon should certainly appear after a Windows restart. *Folders* displays a reminder of this limitation each time you add, change, or remove a custom icon. To suppress this warning, simply check the *Don't show this message again* box. If for some reason you wish to restore the warning, delete the file *Folders.ini* from your Windows folder.

Note that if you right-click a shortcut to a folder, the *Folders—Change icon...* menu item will not appear. To change the icon for a shortcut to a folder, right-click the shortcut, choose *Properties* and click the *Change Icon...* button. You'll see the same icon-selection dialog that *Folders* uses.

Windows gets information about a folder's custom icon by reading a hidden file named *Desktop.ini*, stored within the folder. This file may contain other information related to the Active Desktop feature. For example, if a particular folder represents a channel of Internet information, *Desktop.ini* defines the logo used to represent that channel and the associated URL. When you customize a folder to have a specific background or layout when viewed as a Web page, that information is stored in *Desktop.ini*. And when you choose to enable the new Thumbnail view, that information also is stored in *Desktop.ini*. When you delete a custom icon, *Folders* removes everything that it added to *Desktop.ini* but

For Programmers Only *Folders* is a 32-bit Windows shell extension written in Borland's Delphi 3.0. The full source code for *Folders* is available from PC Magazine Online (www.pcmag.com/download) and demonstrates several interesting programming techniques, including how to:

- use an undocumented function to trigger the standard Change Icon dialog;
- set or clear a folder's system attribute and get the system to notice; and
- traverse a drive's directory structure within a separate thread of execution.

Support Help for *PC Magazine's* free utilities can be obtained in our online discussion areas, both on the World Wide Web (www.pcmag.com/discuss.htm) and on ZDNet in the Utilities section of ZDNet's Tips Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum daily. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who also checks this forum each day, will contact the author for you.

doesn't touch any of the other data. If this deletion leaves Desktop.ini empty, Folders deletes the empty file. And if it originally created a hidden copy of an ICO file, Folders deletes that copy.

Windows Explorer displays the files and folders on your system, but it also displays non-file folders such as Control Panel, My Computer, and Dial-Up Networking. The Folders utility cannot change the icon for a non-file folder, so it does not add the *Folders—Change icon...* menu item to the right-click context

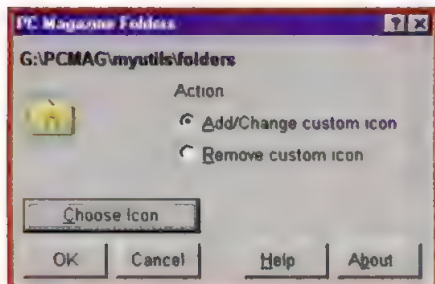


FIGURE 2: From the main Folders window, you can choose a new custom icon or remove an existing one.

menu for such folders. Also, certain folders, such as My Documents and folders within the Start menu, have a special status with Windows. For such folders, even if the Folders menu appears, you may find that your custom icons cannot override the system's settings.

To uninstall Folders, run the *Add/Remove Programs* applet from Control Panel and launch the item titled "PC Magazine Folders." You'll have a choice of removing just the program or removing the program and all the folder-specific icons it added. If you choose the latter option, Folders will examine every folder on every fixed and removable drive on your system. When a Desktop.ini file is found that identifies a custom icon added by Folders, the icon will be removed. Of course, custom icons on removable disks can be deleted only if the disk is in its drive during the uninstall process. Note that Windows itself may create some custom folder icons: These will not be removed. If you uninstall Folders without removing the custom icons it created, the icons will remain. You'll have to reinstall Folders to remove the icons.

Active Desktop gives Windows the potential to display folder icons that are as individual as the icons for data files, but it keeps this potential hidden. *PC Magazine's Folders* utility lets you take advantage of this feature to make your most important folders stand out.

INSIDE FOLDERS

As mentioned above, Folders creates or modifies a hidden file called Desktop.ini in each

folder to give that folder a custom icon. However, there's a bit more to the story: Each folder must also be marked with the system attribute. The latest version of Shell32.dll provides functions for this purpose, but they don't work! The fancy icon-selection dialog is activated by a simple call to the undocumented Windows API function *PickIconDlg*. Folders provides its own uninstall routine, because a standard uninstaller couldn't manage the option of finding and removing all the custom icons added by Folders. One of the biggest challenges in writing Folders was getting Windows Explorer to notice changes in a folder's icon; with advice from Microsoft, I developed a multipronged approach that seems to do the job.

MAKING SYSTEM FOLDERS

For Windows Explorer to recognize that a folder has a custom icon, the folder must have the System file attribute set. Starting with Version 4.71 (the version required by Folders), Shell32.dll includes several functions related to system folders—specifically *PathMakeSystemFolder*, *PathUnmakeSystemFolder*, and *IsSystemFolder*. You would expect these functions to set a folder's system attribute, clear the system attribute, and report whether the attribute is set. Thus, you'll probably be as surprised as I was to learn that they actually set, clear, and report on the *read-only* attribute instead.

Instead of using the misnamed built-in functions, Folders uses the API functions *SetFileAttributes* and *GetFileAttributes* to set, clear, and test the folder's system attribute. The function *MakeUnmake* (see Figure 4), found in the *FolFuncs.pas* unit, both controls the system attribute and alerts Explorer to the change in several different ways.

To start, *MakeUnmake* passes the folder's name and the flag *SHGFI_SYSICONINDEX* to the API function *SHGetFileInfo*. This fills the *iIcon* field of the passed *SHFILEINFO* structure with the index of the folder's icon within the system image list. That index is used later in the function. Next, *MakeUnmake* sets or clears the folder's system attribute, depending on the value of its *isMake* argument. Making this change should be sufficient to cause Explorer to refresh its display of the folder's icon, but in practice it doesn't do so reliably.

The next step is to pass the folder's name and the flag *SHCNE_ATTRIBUTES* to the *SHChangeNotify* API function, explicitly telling Explorer that the folder's attributes have changed. After that, *MakeUnmake* passes the icon index and the *SHCNE_UPDATEIMAGE* flag to *SHChangeNotify*, indicating that the image for the specified icon index has changed. Finally,

it calls *SHChangeNotify* one last time, passing the flag *SHCNE_ASSOCCHANGED*. Thus, Explorer receives four different warnings that it needs to update its display.

SELECTING ICONS

The Win32 API includes a number of common dialogs that are invoked through undocumented functions. Among the dialogs that can be invoked in this way are the *Run* and *Shut Down* dialogs (normally triggered from the corresponding Start menu items) and the *Properties* dialog for a file or folder. For a detailed discussion of these functions, visit the fascinating Web page at www.geocities.com/SiliconValley/4942/common.html. The most useful of the group is *PickIconDlg*, which displays the *Change Icon* dialog box—the same dialog invoked by clicking the *Change Icon...* button on a shortcut's *Properties* page.

PickIconDlg takes four arguments: the window handle of the calling program, a buffer for the filename containing the icon, the length of the buffer, and a pointer to an integer holding the index of the icon within the file. It returns a Boolean value indicating success or failure. You simply load the buffer with the desired initial filename, set the index variable to the desired starting index, and call the function. If it returns True, the filename buffer and index variable hold the user's new selection.

Since this isn't a documented function, though, there's one little catch. Under Windows 95 and 98, the actual function used is *PickIconDlgA*, and the filename is an ANSI string. Under Windows NT, the function is *PickIconDlgW*, and the filename is a Unicode string. This is true of many documented Windows API functions as well, but for the documented functions, Windows itself provides automatic translation of the arguments. Un-

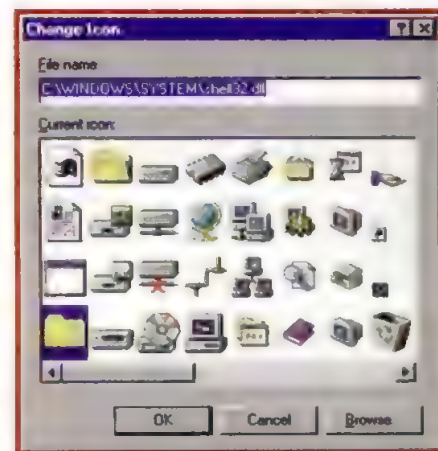


FIGURE 3: In the standard Windows icon-selection dialog, you can browse to choose a file that contains icons and then pick a specific icon from the selection window.

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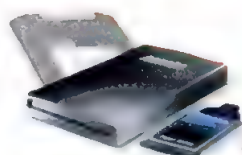


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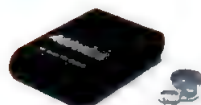


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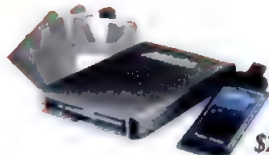
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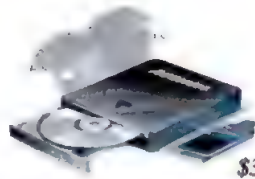
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documented functions don't get this service from Windows, so Folders defines a `PickIconDlg` function (found in the `FolFuncs.pas` unit) that checks the current operating system and calls `PickIconDlgA` or `PickIconDlgW` as appropriate, making the conversion to a Unicode string if necessary.

CLEANING UP

Like all of the utilities that I've written recently, Folders relies on the WISE install system to generate its installation program. This particular installation is unusually simple, because there are no menu shortcuts involved. All the installation program has to do is copy the program files into the Windows folder and register `Folders.dll` with the system. However, uninstalling Folders is beyond the capacity of an ordinary installation script because of the option to remove all the custom icons that Folders added.

The install program for Folders copies a separate program named `Uninstall_Folders.exe` into the Windows folder. This program can be launched via the *Add/Remove Programs* applet in Control Panel or by using PC Magazine Extra's *UnClean* utility, or even by launching it from the *Run* item on the *Start* menu. The first thing the program does is check whether it currently resides in the system-defined Temp folder. If not, it copies itself to that folder, launches the copy, and shuts down.

When the user clicks *OK*, the copy of `Uninstall_Folders` running in the Temp folder calls the `DllUnregisterServer` function within `Folders.dll`. This breaks the link between `Folders.dll` and Explorer, making it possible to delete `Folders.dll`. Note that `Uninstall_Folders` accesses the `DllUnregisterServer` function dynamically, using the API functions `LoadLibrary` and `GetProcAddress`, and it calls `FreeLibrary` afterward. If it instead used a standard external declaration, its own static connection with `Folders.dll` would make deleting the file impossible. Even so, Explorer is deliberately slow in releasing such links, so the uninstall program may not succeed in its deletion. For each of the files that make up Folders, `Uninstall_Folders` makes up to ten attempts at deletion. It warns the user if any files could not be deleted and presents a list of files that will have to be deleted later.

Now comes the interesting part. If the user chooses to delete all custom icons added by Folders, `Uninstall_Folders` spawns a separate thread that scans the folders on every fixed disk on the system. If the program finds a `Desktop.ini` file that defines a custom icon and that also contains the key

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Folders=1 in a section named [PC Magazine], it deletes the [PC Magazine] section and the custom icon information. If Desktop.ini is now empty, the program deletes the entire file. And if the custom icon was a hidden icon copied into the folder by Folders, it deletes that icon too. There's no way to know in advance how many folders will need to be processed, so a percent-complete progress bar isn't possible. To keep the user informed that something is happening, the program repeatedly runs a progress bar from zero to maximum.

The search-and-destroy mission to remove icons added by Folders is handled by a TThread descendant called TFolThread, defined in the unit FilThds. Searching every folder on every drive is a time-consuming task. Delegating it to a separate thread lets the Uninstall_Folders program continue to display properly and respond to the user, while the thread busily searches every folder on the system.

As every TThread descendant must do, TFolThread defines its own Create constructor and overrides TThread's Execute method. The constructor passes True to the inherited constructor, meaning that the thread should be created in a suspended state, waiting for the calling program to trigger its Resume method. It sets FreeOnTerminate to True, meaning that when the Execute method finishes processing, the thread object will be deallocated. And it initializes two private data fields, fTickBack and fDeleted. The former is a simple no-parameters method supplied by the calling program. TFolThread calls this method repeatedly while it's working, and the main Uninstall_Folders program responds by advancing its progress bar. The fDeleted field is a string list that will record the locations of any deleted copies of Desktop.ini (more about that later).

When the calling program activates the TFolThread's Resume method, the Execute method begins its work. It calls the API function GetLogicalDrives to get a list of all drive letters on the system. For each logical drive

```
procedure MakeUnmake(pszPath : PChar; IsMake : Boolean);
VAR SFI : TSHFileInfo;
begin
  SHGetFileInfo(pszPath, 0, SFI, SizeOf(SFI), SHGFI_SYSICONINDEX);
  IF IsMake THEN
    SetFileAttributes(pszPath, GetFileAttributes(pszPath) OR
      FILE_ATTRIBUTE_SYSTEM)
  ELSE
    SetFileAttributes(pszPath, GetFileAttributes(pszPath) AND (NOT
      FILE_ATTRIBUTE_SYSTEM));
  SHChangeNotify(SHCNE_ATTRIBUTES, SHCNF_PATH OR
    SHCNF_FLUSH, pszPath, nil);
  SHChangeNotify(SHCNE_UPDATEIMAGE, SHCNF_DWORD,
    Pointer(SFI.iIcon),
    nil);
  SHChangeNotify(SHCNE_ASSOCCHANGED, SHCNF_IDLIST, nil, nil);
end;
```

FIGURE 4: The MakeUnmake function sets or clears a folder's system attribute and notifies Explorer of the change.

that is a hard disk, a network drive, or a removable drive, it calls the SearchPaths method. This method calls the SearchPath method to process files within the current folder. It then uses a familiar FindFirst/FindNext loop to call SearchPaths recursively for all the folders within the current folder.

The SearchPath method calls fTickBack to let the calling program know it's working, and then simply searches for any files named Desktop.ini in the current path. Of course, SearchPath could easily be modified to search for all files or for files matching a template. When a match is found, it passes the filename to the ProcessFile method. ProcessFile calls the function RemoveOurs, defined in the FolFuncs unit, to clean up anything Folders added to this copy of Desktop.ini. RemoveOurs returns 0 if nothing was removed, 1 if some elements were removed, and 2 if the entire Desktop.ini was emptied and the file deleted. In the last case, TFolThread adds this item to the fDeleted list.

After all folders on all drives have been checked, TFolThread's Execute method flips through the fDeleted list and deletes each file

again. This is necessary because Windows doesn't write INI file changes to disk right away; instead, it caches them. A call to WritePrivateProfileSection with three NULL arguments is supposed to flush the cache. However, I found that when I deleted an instance of Desktop.ini immediately after writing to it, the file would frequently reappear even though I made the specified call to WritePrivateProfileString. To avoid this problem, TFolThread keeps a list of the Desktop.ini files it deletes and makes a second pass through this list after it finishes checking all folders on the system.

Folders is not a complicated program, but getting it to function correctly took a lot of work and research. It seems amazing that, in the latest version of Windows, Microsoft would make custom folder icons possible without making them available to the user, but that's just what it did. **PC**

Neil J. Rubenking, the author of Folders, is contributing technical editor of PC Magazine. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

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User-to-User

BY NEIL J. RUBENKING

Use Wininit.ini to Delete Files

Here's a tip for programmers, especially those working on uninstall programs: Windows 95 will automatically delete files via instructions it finds in the file Wininit.ini when it is loading. This is a good way to get Windows to delete your program when the uninstall is complete, since this can't be done within the program itself.

For this to work, your program must create Wininit.ini in the Windows directory. You need to create a [Rename] section in the file and then place in that section the names of any files you want to delete, using the following format:

```
[Rename]
NUL=C:\EXAMPLE\UNINST.EXE
NUL=C:\EXAMPLE\UNINST.HLP
NUL=C:\EXAMPLE\UNINST.CNT
NUL=C:\EXAMPLE
```

When Windows 95 restarts, you'll see a message stating the following: "Please wait while Setup updates your files..." During this time, files are being deleted. In the above example, the three files listed are removed, and then the directory C:\Example is deleted. Finally, Windows deletes the Wininit.ini file itself. Thus, your program can be completely uninstalled.

If you do use this technique, make sure your installation program searches for and reads Wininit.ini if available, to prevent files from being deleted if your program was uninstalled and reinstalled within the same Windows session.

AMADEO MAPELLI
via the Internet

```
REGEDIT4
[HKEY_LOCAL_MACHINE\SOFTWARE\
Microsoft\Windows\CurrentVersion\
explorer\Shell Icons]
"19"="C:\\Windows\\System\\p1.bmp"
"20"="C:\\Windows\\System\\p2.bmp"
"21"="C:\\Windows\\System\\p3.bmp"
"22"="C:\\Windows\\System\\p4.bmp"
"23"="C:\\Windows\\System\\p5.bmp"
"24"="C:\\Windows\\System\\p6.bmp"
```

FIGURE 1: This file changes the icons for the six main Start menu items to six bitmaps that you place in the Windows System directory.

PC MAGAZINE: During the final phase of installing Windows 95, Wininit.ini is used to clean up and rename files used by Setup itself. The Windows 95 Resource Kit mentions that three sections of Wininit.ini are processed, but it describes only the [Rename] section. The main purpose of Wininit.ini is to permit deleting, renaming, or upgrading files that can't be manipulated while Windows 95 is running. Note that since this file is processed before Windows 95 loads, it does not support long filenames.

And here's another good use for this technique: The January 20, 1998, User-to-User column presented a method for personalizing your Start menu by replacing the icons for the six main items (from Programs . . . down to Run . . .) with six sections of one tall, skinny bitmap. With the Wininit.ini technique described here, you can almost completely automate this process!

First, create a bitmap 32 pixels wide by 192 pixels high and split it up into 32-by-32 bitmaps, P1.bmp through P6.bmp, as described in the previous article. Place these six files in the Windows System directory. Launch Notepad or Wordpad and type the lines shown in Figure 1, saving the file as Desktop.reg. Be sure that the registry key name [HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\explorer\Shell Icons] appears on a single long line.

Now create Personal.bat:

```
@ECHO OFF
REGEDIT /S DESKTOP.REG
ECHO [Rename]>C:\WINDOWS\WININIT.INI
ECHO NUL=C:\WINDOWS\SHELLI-1.>>C:\
WINDOWS\WININIT.INI
ECHO Restart Windows 95 to activate
changed icons
```

This batch file incorporates the registry changes described by Desktop.reg into the registry. As noted in the earlier article, these changes have no immediate effect, because Windows 95 stores the active shell icons in a

```
REGEDIT4
[HKEY_LOCAL_MACHINE\SOFTWARE\
Microsoft\Windows\CurrentVersion\
explorer\Shell Icons]
"19"="C:\\WINDOWS\\SYSTEM\\cool.d11,4"
"20"="C:\\WINDOWS\\SYSTEM\\cool.d11,2"
"21"="C:\\WINDOWS\\SYSTEM\\cool.d11,6"
"22"="C:\\WINDOWS\\SYSTEM\\cool.d11,3"
"23"="C:\\WINDOWS\\SYSTEM\\cool.d11,25"
"24"="C:\\WINDOWS\\SYSTEM\\cool.d11,5"
```

FIGURE 2: If your system has the Microsoft Plus! pack loaded, use this file to restore the normal icons to the Start menu.

```
REGEDIT4
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\
CurrentVersion\explorer\Shell Icons]
"19"="C:\\WINDOWS\\SYSTEM\\shell32.d11,19"
"20"="C:\\WINDOWS\\SYSTEM\\shell32.d11,20"
"21"="C:\\WINDOWS\\SYSTEM\\shell32.d11,21"
"22"="C:\\WINDOWS\\SYSTEM\\shell32.d11,22"
"23"="C:\\WINDOWS\\SYSTEM\\shell32.d11,23"
"24"="C:\\WINDOWS\\SYSTEM\\shell32.d11,24"
```

FIGURE 3: If the Microsoft Plus! Pack is not present on your system, use this file to restore the normal icons to the Start menu.

file called ShellIconCache. Deleting this file within Windows doesn't help, because it gets written again when Windows shuts down. Personal.bat handles this problem by setting up Wininit.ini to delete ShellIconCache the next time Windows restarts. Run Personal.bat and restart Windows and you've got a personalized Start menu.

To restore the original icons, create Plus.reg (Figure 2) if your system has the Microsoft Plus! Pack installed or Normal.reg (Figure 3) if not, and modify Personal.bat to use this file instead of Desktop.reg. If your Windows directory is not C:\Windows, you will have to edit all three of the REG files as well as Personal.bat. Remember that when you enter the correct Windows directory in the REG files, you must double every backslash.

Do note that the technique for personalizing the Start menu breaks down if you install Internet Explorer 4. IE 4 inserts a seventh item (called Favorites) into the Start menu, and it apparently increases the spacing between the menu items as well. At present, this technique is restricted to plain, unadorned Windows 95.



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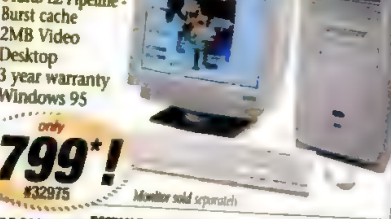
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Ask Our Advisors

HARDWARE

Don't Lose the Blues

I have a 15-inch color monitor that has an intermittent problem. From time to time, the monitor begins to display white as a very pale yellow and then flickers back to white. This problem may repeat several times, but the pale yellow eventually returns to white and remains white for 99 percent of my work session. This problem can occur at any time, but it often occurs when I first turn on the PC and boot up to the desktop with the white background. The problem generally persists for less than a minute. Do you have any suggestions on how to troubleshoot this problem?

GEORGE RAYZIS
Glassboro, New Jersey

PC MAGAZINE: The white image on your monitor is made from the combined red, green, and blue lights emitted by the phosphors on the front of the screen. The flickering yellow effect is an indication that there is a problem with the blue signal; red and green light combine to make yellow.

One of the key symptoms you cited is that the problem tends to occur when the computer is first turned on and then goes away once the system has been running for a while. A good working assumption is that such a problem is the result of a poor electrical contact, as opposed to a problem with an electronic component. So start by checking for a loose connection.

Try reseating the monitor cable in its connections. If that doesn't resolve the problem, try a different monitor cable (assuming that the cable can be disconnected from the monitor). If that fails to resolve the problem (or if the cable cannot be removed), try plugging the monitor into a different computer. If this works, then the problem may be with the graphics adapter in the computer. If the same problem appears with another computer, then the monitor itself is probably to blame.

If these search steps lead you to the monitor, then you should get it professionally repaired. Unless you are trained to work with CRTs, do not open the case and attempt a repair yourself. There are capacitors inside that can carry a harmful or even deadly electrical charge, so leave the repairs to the pros. If you live near any major city, you should be able to find a local repair shop. Many will do repairs of this sort for a flat rate, often under \$100 for a 15-inch monitor.—*Alfred Poor*

OPERATING ENVIRONMENTS

Distinguishing 16-Bit and 32-Bit Programs

I've recently been comparing the relative performance of the Windows 3.1 and Windows 95 versions of Media Player, and I realized that it is not the least bit obvious whether a program is 32-bit or 16-bit. In particular, I noticed that Win 95 can make the title bars all look the same and give them all properties sheets. So the question is: How do you tell whether a program is a real 32-bit Windows program? Is there a way to do this short of examining the EXE binary?

NICHOLAS CUPERY
via the Internet

PC MAGAZINE: All Windows programs, whether 16-bit or 32-bit, begin with an old-fashioned DOS executable header. The first 2 bytes of an executable, any DOS or Windows type, are still MZ, the initials of Mark Zbikowski (an early DOS programmer). A Windows 16-bit executable has a second "New Executable" header later in the file. The location of this second header is stored in the 60th and 61st bytes of the DOS header, and the first 2 bytes of the NE header are the characters NE. A Windows 32-bit executable also has a second header, at the same offset found in the DOS header, but this one's first 2 bytes are PE, for *Portable Executable*. Thus you could determine whether a file is 16-bit or 32-bit by painstakingly examining a few bytes in its second header. Fortunately, that's not necessary.

Under Windows 95 and Windows NT 4, a quick way to determine whether a program is 16-bit or 32-bit is to right-click the EXE file and choose *QuickView*. In the first block of data, titled *Technical File Information*, look for the line named *Signature*. If its value is 454e, the file is a 16-bit executable. If 4550, the file is 32-bit. Why? If you split that signature value into two two-digit hexadecimal numbers, reverse them, and convert them to ASCII characters, you get NE and PE respectively!

—Neil J. Rubenking

DATABASES

Filling a Form from the Previous Row

When I used to work with dBASE, there was a command, SET CARRY ON, which told dBASE to fill in the fields in a data entry form

with the same data that had been entered in the previous record. This command was quite a time-saver, because frequently the data is rather repetitious. I can't find a similar capability in Microsoft Access. There is a keyboard shortcut (Ctrl-') to fill in one field at a time, but how can I fill in all of the fields at once?

WES DICK
Calgary, Canada

PC MAGAZINE: There's no simple way that I know of other than writing some custom code. You could cut and paste rows, but this copies forward fields that shouldn't be copied, such as primary-key fields and fields that require unique values. Microsoft's *Duplicate Record* option in the Command Button wizard does this too.

The code in Figure 1 demonstrates how to implement a copy-forward feature in an Access form. You place the code in the form's Class Module, with the bulk of the code residing in the form's On Current event (`Private Sub Form_Current()` in the listing). You must then add logic somewhere in your form to set the `bCopyForward` public variable to either True or False, to enable or disable the

OUR ADVISORS

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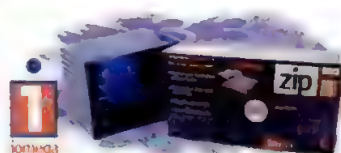
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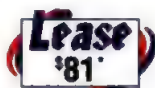
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' An empty variant used to assign empty to
' varCopyFromRow
Public bCopyForward As Boolean
' Set this to True to enable copying forward
'
Private Sub Form_Current()

' This function copies forward data from the previous
' row if bCopyForward is set to true
Dim rstFormRecordSet As Recordset, rstCopyRecordSet As
Recordset, ctlControl As Control
On Error GoTo Form_Current_Exit
' Set up the error handler
'
' If this is a new record and copy forward is enabled
' then either duplicate the previously entered values
' or the values in the row bookmarked in
' varCopyFromRow
If Me.NewRecord And bCopyForward Then
    Set rstFormRecordSet = Me.RecordsetClone
' Get access to the form's recordset
    Set rstCopyRecordSet = rstFormRecordSet.Clone
' Clone the form's recordset
'
' If varCopyFromRow has a bookmark value it indicates
' the row to copy from, otherwise we copy from the
' last row in the recordset.
    If rstCopyRecordSet.Bookmarkable And Not
IsEmpty(varCopyFromRow) Then
        rstCopyRecordSet.Bookmark = varCopyFromRow
' Get access to the copy from row
    Else
' Otherwise
        rstCopyRecordSet.MoveLast
' Copy from the last row
    End If

```

```

    On Error Resume Next
' Ignore errors in this section
'
' Note that this copies only data referenced in the
' form's bound controls. If there is row data (fields)
' not bound to controls on the form, it is not copied.
' Thus we are "filling in a form," not "copying a
' record."
    For Each ctlControl In Me.Controls
' For each control on the form
'
' The fields named here are those we do not want to
' copy forward
        If ctlControl.Name <> "EmployeeID" And _
            ctlControl.Name <> "Photo" Then
            ctlControl =
rstCopyRecordSet(ctlControl.ControlSource)
        End If
    Next
    On Error GoTo Form_Current_Exit
' Restore the error handler
    varCopyFromRow = varEmpty
' Clear the copy-from row bookmark
    rstCopyRecordSet.Close
' Perform appropriate clean up chores
    rstFormRecordSet.Close
    Me!FirstName.SetFocus
' Set focus to the first control
Else
    If Me.NewRecord Then
        Me!FirstName.SetFocus
    Else
        If Not IsEmpty(Me.Bookmark) Then
' If there is a bookmark we can copy
            varCopyFromRow = Me.Bookmark
' Make this the copy-from row
        End If
    End If
End If
Form_Current_Exit:
End Sub

```

FIGURE 1: The code shown here demonstrates how to implement a copy-forward feature in your Microsoft Access form, to fill a form with data from the previous record automatically.

copy-forward feature. You could do this in the form's On Open event, for example. Or if you want the user to decide, you could implement a check box on your form that enables or disables the feature by setting the bCopyForward variable.

The form's On Current event is called every time you navigate to a different row. The code placed here determines whether the row you just navigated to is a new row. If it is and if copy forward is enabled, the code fills in the controls on the form with data from the old row.

You'll want to customize the loop that pop-

ulates the controls with data to your environment. It appears this way:

```

For Each ctlControl In Me.Controls
' The fields named here are those
' we do not want to copy forward
If ctlControl.Name <> "EmployeeID"
And _
    ctlControl.Name <> "Photo" Then
    ctlControl =
rstCopyRecordSet(ctlControl
.ControlSource)
End If
Next

```

The code loops through every control on the form and attempts to populate it. You'll want to cancel this for any control that *should not* be copied forward. For example, a control bound to a primary-key field (such as EmployeeID) shouldn't be copied forward, because you can't have a duplicate primary key.

Similarly, if you have a control bound to a field for which a unique index exists, that control shouldn't be copied forward either, for the same reason. Other examples are application-dependent, but if it doesn't make sense to copy the field forward, you'll



want to edit the loop to include that field in the If statement. In the example we provide in Figure 1, I've included two fields that should not be copied forward, EmployeeId and Photo. You need to change these to suit your application, and if you have more than two, you need to add them to the If statement. For instance, if you wanted to add the HomeAddress field, you'd edit the line to read as follows:

```
If ctlControl.Name <> "EmployeeID"
And _
    ctlControl.Name <> "Photo" And _
    ctlControl.Name <> "HomeAddress"
Then
```

Further down in the listing you'll see two lines that look like this:

```
Me!FirstName.SetFocus
```

This sets the focus to the FirstName field on my form, which is where I want the user to begin editing the new record. Whenever you begin editing a new record, you should change the FirstName part in both of these lines to the name of the control on your form that you want to receive focus.

The code in Figure 1 can be downloaded from www.pcmag.com/pctech. Look for Fillform.vba in the PC Tech archive file for this issue.—*Sal Ricciardi*

WORD PROCESSING

Inserting Tables in Text Boxes In Word 97

In Microsoft Word 7 it was a simple matter to create a table and then insert a frame around it so that you could move the table to any position by clicking on the frame and dragging. All you had to do was select the table, then choose Insert | Frame. Unfortunately, Microsoft Word 97 no longer offers a Frame choice on its Insert menu. I haven't figured out how to get the same result using text boxes. Has Word 97 really lost this capability, or is there a way to do this after all?

JOHN MCCOLOUGHM
via the Internet

PC MAGAZINE: You're on the right track in trying to insert a table in a text box, but the procedure is a bit different from the technique for using frames in Microsoft Word 7. A more interesting answer, however, is that you can still use frames if you prefer. One of the secrets of Microsoft Word 97 is that frames aren't really gone. They're just hid-

den where you can't get at them unless you know where to look.

To insert a table in a text box—which is what Microsoft recommends—you have to create the text box first and then insert the table. Choose *Insert | Text Box*, and the mouse cursor will change to a plus sign. Click anywhere on the page to designate one corner of the text box. Drag to define the size of the box, and release the button to finish. Word will insert the text box and leave the text cursor inside the box.

If you create a table at this point, using the *Table | Insert Table* command or the *Insert Table* button on the Standard toolbar, Word will insert it inside the text box. You can then adjust the size of the box to match the table. You'll probably also want to choose *Format | Text Box*, then *Colors and Lines*, and change the line color to *No Line*.

The only problem with this approach is that the size of the text box will not automatically adjust if you change the table size—if you add or delete rows, for example. For that you need a frame, with *Width* and *Height* set to *Auto*. One of the lesser-known commands in Word will let you convert the text box to a frame. (To see the command, select the text box and choose *Format | Text Box*, then *Text Box*. The *Convert to Frame* button is in the lower-right corner.) This is a poor choice in this case, however, since converting to a frame will usually change the height of the table rows.

Fortunately, there's a much better answer: Word 97 still offers an *InsertFrame* command that works just like the *InsertFrame* command in Word 7. You need only add it to a menu or toolbar.

To add the command, choose *Tools | Customize*, then *Commands*. In the *Categories* box, select *All Commands*. In the *Commands* box, scroll to the *InsertFrame* command. If you want to add it to the *Insert* menu, click on the *InsertFrame* choice and drag it to the *Insert* menu. Word will open the menu, so you can drag the new menu item to whatever position you like. Release the button to drop it in place.

If you prefer to use the command as a toolbar button, drag it to the appropriate toolbar. (You can do both if you like.) When you're finished, close the dialog box and then close Word so the program will save the changed menu to disk. (If Word asks whether it's okay to save changes made to *Normal.dot*, answer yes.) You'll now be able to use the *Insert | Frame* command the same way you used it in Word 7, and a table in a frame will behave the same way it would in Word 7.—*M. David Stone*

SPREADSHEETS

Keeping Track of Time

I use an Excel spreadsheet to keep track of aircraft hours. I format the time cells by choosing the Time option from the Format Numbers dialog box and then selecting 37:30:55, for hours:minutes:seconds. I have discovered, though, that if I input a time greater than 9,999 hours, Excel does not recognize the input as time. It gives me text instead. Is there a way to get Excel to recognize this as a time?

I have tried splitting the time up into two parts less than 9,999 hours, then adding the two cells and formatting the result as 37:30:55. That seems to work. Is there another way? Also, Excel always seems to display something in the formula bar that looks like a date and a time, even though I'm interested only in the time. For 9,999 hours, for example, the formula bar shows 2/19/1901 3:00:00 PM. Is there a way to get rid of this?

PREETHAM PHILIP
via the Internet

PC MAGAZINE: You're right. Excel treats 10000:00 as an out-of-range input value and misinterprets the input as text. (It does exactly the same thing if you give it a minute or second value greater than 60.) You've found the workaround yourself. Simply add two in-bounds times together and Excel will happily format the result as hours:minutes:seconds.

As for that annoying date-and-time display on the formula bar, the only way I know to get rid of it is to suppress the formula-bar display altogether. You can do that by choosing *View* and deselecting *Formula Bar*.

—*Craig Stinson*

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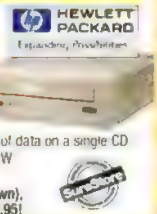


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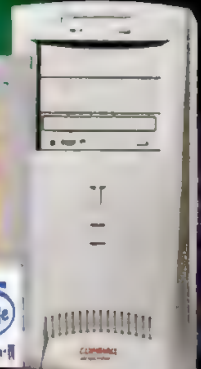
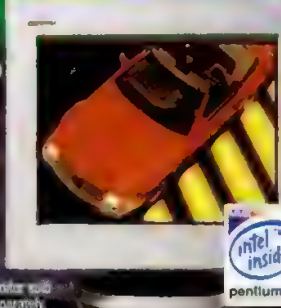
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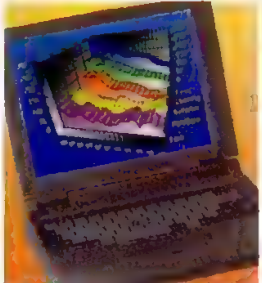


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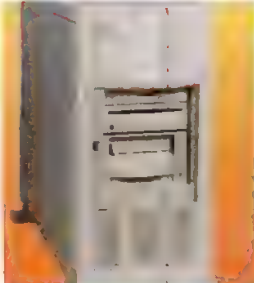


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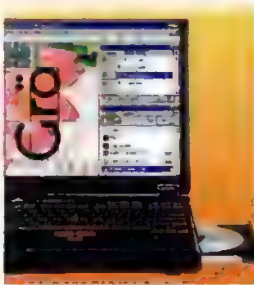


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100617	350PII/64MB/4.3GB	\$1749
100966	350PII/64MB/4.3GB/32X	\$1779
58873	400PII/64MB/10.1GB/32X	\$2299

IBM

IBM PC 300 GL Desktop

59583	350PII/64MB/3.2GB	\$1449
59582	400PII/64MB/3.2GB	\$1689

IBM PC 300 GL Minitor

59584	350PII/64MB/6.4GB	\$1689
59585	400PII/64MB/6.4GB	\$1819

IBM PC 300PL Desktop

54681	350PII/64MB/6.4GB	\$1829
54682	400PII/64MB/6.4GB	\$1959

IBM PC 300PL Minitor

54686	350PII/64MB/4.2GB	\$1779
54687	400PII/64MB/6.4GB	\$1979



Inteva Desktop

100383	266MMX/32MB/3.2GB/24X/56K	\$899
100400	266K6/32MB/3.2GB/32X	\$799
100387	266MMX/32MB/3.2GB/32X/56K	\$799

Inteva Minitor

100395	266MMX/32MB/4.3GB	\$799
100397	266MMX/32MB/4.3GB/Windows NT	\$899
100388	266MMX/32MB/4.3GB/32X/56K	\$999
100396	300MMX/64MB/6.4GB	\$999
100384	300MMX/32MB/3.2GB/32X/56K	\$999
100385	333MMX/48MB/4.3GB/32X/56K	\$899
100706	333MMX/64MB/6.4GB/32X/56K	\$999
100390	333MMX/64MB/6.4GB/32X/56K	\$1199

SONY

Sony VAIO

58143	266PII/32MB/4.3GB/24X/33.6K	\$989
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Toshiba Equium

54225	266PII/32MB/4GB/24X/10/100	\$1119
54226	300PII/32MB/4GB/24X/10/100	\$1259

NOTEBOOKS

Acer

Acer Extensa

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56678	200MMX/32MB/2.1GB/20X/12.1" Act.	\$1479

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Compaq Armada

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53398	200MMX/32MB/3.2GB/20X/56K/12.1" HPA	\$1749
56568	233MMX/32MB/3.2GB/20X/56K/12.1" TFT	\$1985
46940	233MMX/32MB/3GB/30X/33.6K/12.1" TFT	\$2599
45452	233MMX/32MB/3GB/30X/33.6K/12.1" TFT	\$2599
46854	233MMX/32MB/4GB/20X/33.6K/12.1" TFT	\$2899
58895	233PII/32MB/4GB/24X/56K/12.1" TFT	\$2399
53399	266MMX/32MB/4GB/20X/56K/13.3" TFT	\$2399
50574	266MMX/32MB/4GB/20X/33.6K/12.1" TFT	\$3199
55275	266PII/64MB/5GB/20X/33.6K/13.3" TFT	\$4199

Compaq Presario

57588	233MMX/32MB/3.2GB/24X/56K/12.1" HPA	\$1499
57599	266K6/32MB/3.2GB/24X/56K/12.1" HPA	\$1799
57600	266K6/32MB/4GB/24X/56K/12.1" HPA	\$2099
57601	266PII/64MB/4GB/24X/56K/12.1" TFT	\$2099
58296	266PII/64MB/4GB/24X/56K/13.3" TFT	\$2899

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Fujitsu LifeBook

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56428	266MMX/32MB/4GB/20X/56K/12.1" TFT	\$1799
46036	233MMX/32MB/5.0GB/20X/56K/13.3" TFT	\$2099
101190	266MMX/32MB/5.0GB/24X/56K/13.3" TFT	\$2299

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Hitachi VisionBook

59247	266MMX/48MB/4GB/20X/56K/13.3" TFT	\$2899
58500	266MMX/32MB/3.2GB/24X/56K/12.1" TFT	\$2199
100119	266MMX/64MB/4GB/24X/56K/13.3" TFT	\$3199
102033	300PII/64MB/6.4GB/24X/56K/13.3" TFT	\$3599

IBM

IBM ThinkPad 350

44922	166MMX/16MB/2.1GB/12.1" HPA	\$1299
101585	233PII/32MB/4GB/24X/13.3" Act.	\$2449
101586	300PII/32MB/4GB/24X/13.3" Act.	\$2999
101639	300PII/32MB/4GB/24X/13.3" Act.	\$3199

IBM ThinkPad 560

41591	166MMX/16MB/2.1GB/12.1" Act.	\$1249
101593	233PII/32MB/4GB/56K/12.1" Act.	\$2599
101594	300PII/64MB/6.4GB/56K/12.1" Act.	\$3599
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101589	300PII/64MB/5.1GB/24X/56K	\$4299
101590	300PII/64MB/5.1GB/OPE	\$4399

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101584	300PII/64MB/8.1GB/24X/56K	\$2499
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56361	Cassiopeia E-10	\$395
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52245	CrossPad	\$399.95
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46385	REX PC Companion for Laptops	\$139.95
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51843	Velo 500 16MB w/Dock w/\$100 instant rebate	\$499.95
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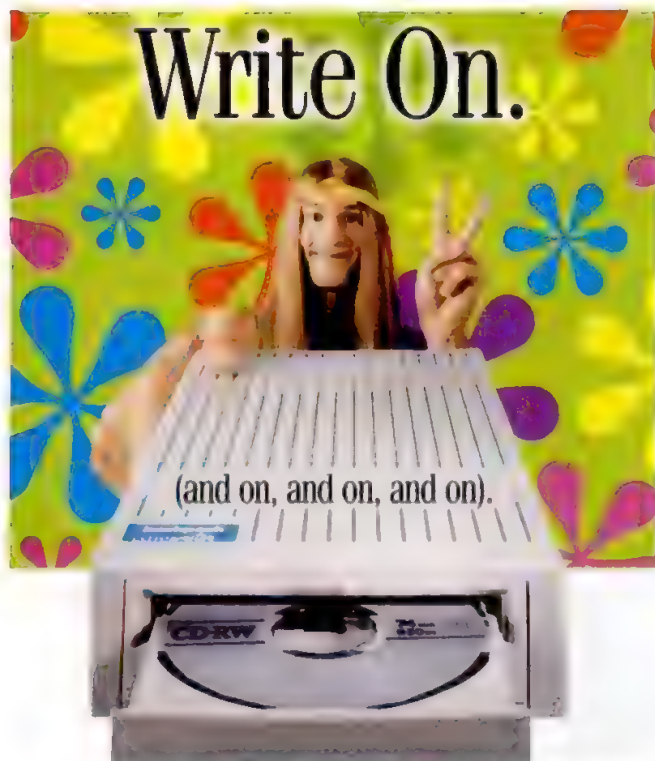
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In case you haven't heard, the backpack family of products includes diskette drives, hard drives and cd-rom drives. The backpack cd-rewriter, like all the rest, is compatible with notebook and desktop PCs. It also comes with smart printer-pass-through technology. You're just one cable connection away from a world of music and data. Outasight, man!



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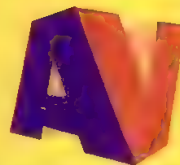


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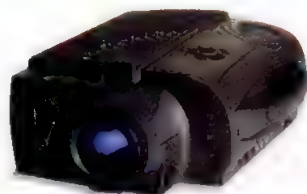
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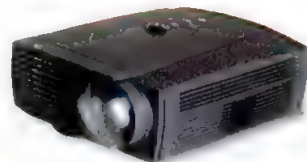
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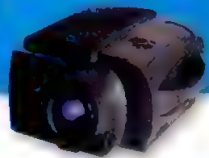
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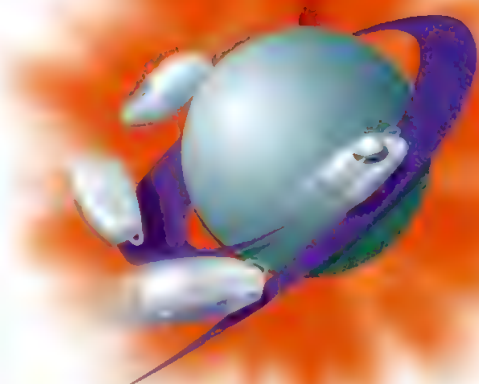
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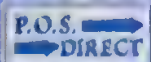
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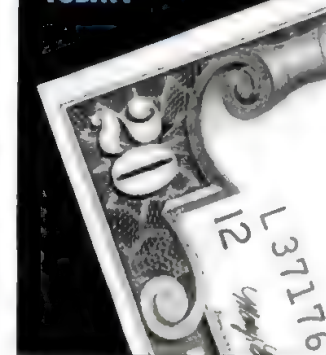


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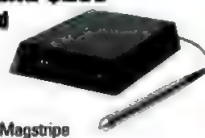
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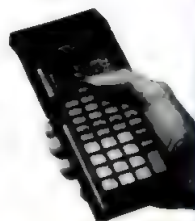
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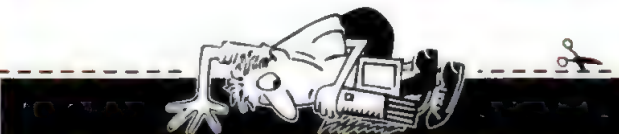
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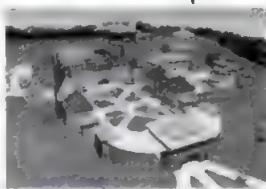
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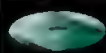
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After Hours

Feel for the Game

Force-feedback peripherals get you into the game as never before.

By Shane Mooney

The jolting sensation of crashing into the divider as you careen around a race-track, the g force pulling against you as your fighter-bomber tears through the sky: These are the benefits of force-feedback peripherals. Force feedback introduces a sensory experience to game play by simulating the physical components of the game.

Although the devices work only with force-feedback-enabled software, the market is definitely on the rise, which is why we decided to test five of them: one steering wheel, three joysticks, and one chair.

BSG Intensor

Although a computer game is just a computer game, a game enhanced by the BSG Intensor is an immersive experience.

Whereas other force-feedback devices are limited to special software-enhanced titles whose biggest impact is below the elbow, the Intensor will rattle your chest bones and surround you in sound while you play any computer or video game.

The chair has a five-driver audio system built right into the seat; the speakers are strategically placed so that none are covered when you sit. There's also an optional subwoofer and chair base.

Setting up couldn't be simpler, with no special software to conflict with Microsoft Windows and no cards to install. Just run the RCA jacks that normally go to your speakers into the chair's receiver and you're ready to shake, rattle, and roll.

Sure, the top-notch sound that comes from the built-in speakers alone is almost enough to justify purchasing the chair, but it's the nonstop rumbling that comes from within that really sends this chair over the edge. The Intensor responds dynamically to the bass in a game. Pop a bad guy with a standard first-person pea-shooter and you'll feel the seat acknowledge the kickback with a gentle shake. Unload an over-the-shoulder rocket into a crowd of monsters and it'll feel like the apocalypse with every explosion, crash, and smash.

The only downside to this

experience is that the seat is built for rumbling and not for comfort. The Intensor is not as bad as a bleacher seat, but it's not quite as relaxing as a recliner either.

CH Products Force FX

The CH Products Force FX was the first joystick out of the starting gate in the force-feedback race, and early adopters weren't disappointed. Although in its infancy force feedback was little more than a gee-whiz technology, it's matured quite a lot, and the Force FX has held up quite well.

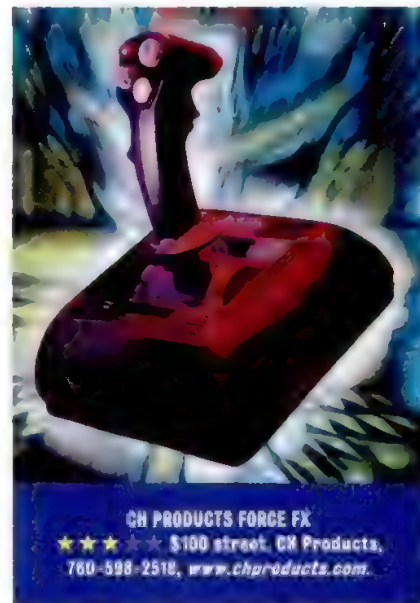
Those who've flown flight simulators will recognize the stick as the same F-16 handle used on the CH Products CombatStick, with two four-way hat switches and six fire buttons. The CombatStick's small base is replaced by a heavy bottom housing the FF motors.

Oddly enough, the Force FX is the only stick that lacks a throttle, so you'll want to use the non-FF CH Products Pro Throttle (\$100 street) for maximum game immersion.

The Force FX needs both a game port and a serial port in addition to the power block common to all FF products. And for those who thought that DOS was indeed dead, the DOS-based installation software and programming utility prove quite the contrary.

This doesn't mean that the stick won't work in

Windows: It'll rock the socks off any game supporting the force-feedback protocol, including Descent II and SODA. In games such as Air Warrior II, you get a host of effects for stalls, crashes, explosions, and



CH PRODUCTS FORCE FX
★★★★★ \$100 street. CH Products,
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gun recoil.

Although the Force FX is nearly identical in quality to the Microsoft SideWinder Force Feedback Pro, the SideWinder wins out by the narrowest of margins because of its Windows-friendly programming

INSIDE

BATTER UP

We test four baseball simulations that bring the energy and excitement of the ballpark to your PC. *Page 317.*



BSG INTENSOR
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After Hours

utility and ergonomic design. But if the only games you play are of the aerial combat variety, then the Force FX is the stick for you.

Logitech WingMan Force

Ever since Logitech entered the joystick market with its WingMan line, the awards and accolades have poured in. The company is unlikely to stop with the Logitech WingMan Force—truly the next generation of joysticks.

The setup of the WingMan is very similar to that of the Microsoft SideWinder Force Feedback Pro, except that the former uses a serial port instead of a game port. You can also plug it into a USB port. The software is similar as well, offering a Microsoft Windows utility that enables you to program the joystick for your favorite games. In addition, the WingMan works with the same games as the SideWinder—those that use DirectX or the I-Force API.

The classic sculpted grip that appeared in earlier WingMan models is back, along with the nine programmable buttons, an eight-way hat switch, and a throttle wheel. Though larger than the SideWinder, this prod-

uct has a solid and sleek construction that lets you rest your left hand comfortably on its base for easy manipulation of the extra buttons.

The one component that makes this joystick different from the CH Products Force FX and the SideWinder is a unique cable drive system, which can provide as much as 1 pound of force and gives the unit a measurably quieter and smoother motion than its FF siblings. The feedback is also a tad more precise.

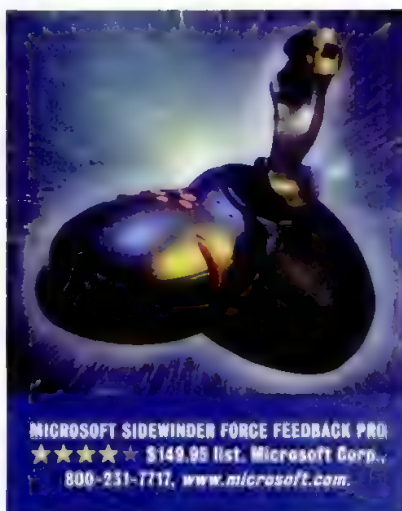
Our only quibble is that the recommended system is a Pentium MMX/66, which makes this stick a bit more demanding than the SideWinder.

Microsoft SideWinder Force Feedback Pro

After going a few rounds with the Microsoft SideWinder Force Feedback Pro, you begin to understand the purpose of force-feedback technology.

Installation is surprisingly easy; all you need is a free outlet and a game port and you're good to go. Naturally, the stick comes with the necessary input software. You get the stick and a game bundle that includes one full game (Interstate 76) and two demos (MDK and Shadows of the Empire).

The SideWinder sports eight buttons and an eight-way hat switch, with a handy shift feature that gives each button and the hat a secondary function. A throttle dial replaces the sliding throttle on the first-generation SideWinder stick, but Microsoft has retained the swiveling shaft for rudder control and movement along the y-axis.



MICROSOFT SIDEWINDER FORCE FEEDBACK PRO
★★★★★ \$149.95 list. Microsoft Corp.,
800-231-7717, www.microsoft.com.

Digital-optical tracking means that you will never have to calibrate the stick.

When it comes to actual game play, the stick is a blast to use. In the MDK demo, the stick waggles in time with your character's footsteps, and you feel a different feedback with each weapon. Shadows of the Empire is even better; the stick responded as though the snow-scooper we were piloting were pulling g's. Naturally, the joystick is pretty ho-hum on non-FF games: too bulky for average game play yet hardly worth \$150 if you don't have the games to support it. But as more games take advantage of force feedback, this solid joystick from a solid company will become a better value.

SC&T Ultimate Per4mer Force Feedback Racing Wheel

Thanks to SC&T International and the SC&T Ultimate Per4mer Force Feedback Racing Wheel, racing sims have been brought to a whole new level of realism.

The wheel itself has a big cutaway up top for unimpeded monitor viewing, and it sports no less than 15 buttons and a

four-position viewing hat—all stemming from a sizable black plastic wedge that clamps to your desk. Having tested more than our share of shoddy wheels, we enjoyed the Per4mer's solid construction.

Rounding out the package are the best pedal units available at any price. The angled foot pads swivel slightly and are perfectly spaced on the base.

The Per4mer hooks up to your serial port and has to be plugged into an outlet at all times, even for non-FF games.

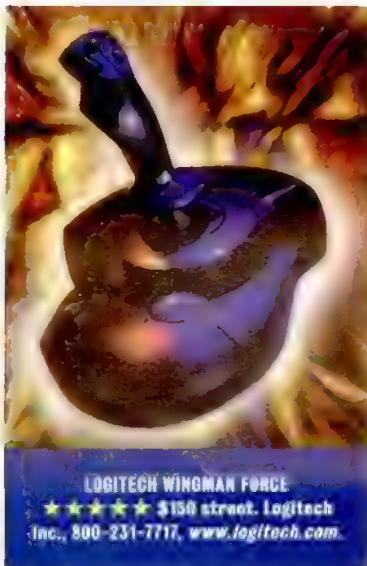
Once the setup is complete, you'll find that game play is intense with the Per4mer. We put the wheel through its paces with Ultimate Race Pro and found that it gave heavy resistance whenever we tried to turn hard on the tight corners. This gives you an entirely different strategy for playing a racing game. Instead of depending on your vision to judge whether you're going too fast into a turn, you can actually feel whether



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your car can negotiate it.

A lack of FF-compatible titles may lead some to think that the Per4mer is for hardcore gamers only, but its excellent design (and the fringe benefit of force feedback) makes it the wheel of choice for any racing sim fan.



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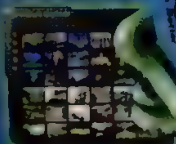


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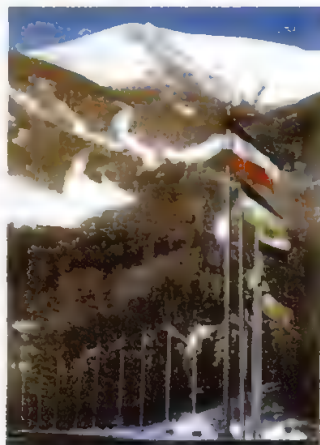
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Swinging for the Stands

The baseball season may be winding down, but the games are hotter than ever.

By S. Jae Yang and Roderick A. Beltran

Baseball fans, by now you are either gloating over your team's pennant-winning finish or grudgingly looking forward to the next season. If you want to reenact your team's glory or rewrite its history, consider these five entries to the baseball simulation game arena. (Sierra Sports' promising Baseball 2000 game wasn't available in time for our roundup.)

With this year's crop of sims come more sophisticated AI (artificial intelligence), more stable network play, and 3-D graphics. Some games even let you rebuild your sorry franchise.

HardBall 6

With a lineage dating back to DOS days, HardBall 6 is a venerable and legitimate challenger to Triple Play 99. It offers a better command of strategies that will please the baseball purists and aficionados, but its 3-D animation and scenes are not as lifelike.

HardBall 6 offers a few great features: You can easily access the controls on the fly to call situational plays such as a hit-and-run or bring in your infield. While the runners are taking their lead, you can keep an eye on them through the PIP (picture-in-picture) window. If you've made a great catch, you can save it in instant replay for future viewing pleasure.

As a manager, you get to build a team through an amateur draft, then strengthen that team through key trades during the season. With the game's minor-

league system, you can cull young talent and develop your team's future prospects. You can also view or edit the scouting report on each player. An updated major-league roster can be downloaded from Accolade's HardBall 6 site.

Another worthwhile addition to the game is the "All-Time" team, which lets you field a team with your choice of the 24 greatest players of all time, including Babe Ruth and Whitey Ford.

Novice players can first learn how to field or hit in the Training Camp. If you think you've found your stroke, challenge some sluggers in the Home

Run Derby. And if you find the computer is no longer a worthy competitor, play with another player over a network (via TCP/IP or IPX) or modem.

The 3-D animation in HardBall 6 is fairly good, and the stadiums are modeled authentically. But the textures applied to the scenes and objects are coarse and crude, and the players do not move fluently enough to induce a sense of realism. You find many typical baseball moves, and all players move the same way. There are no signature moves or variations among the players' styles.—S/JY

High Heat Baseball 1999

High Heat Baseball 1999 offers TruPlay AI (artificial intelligence), which supposedly ensures physically possible, realistic outcomes in the game. But the 3-D animation here is crude, unrealistic, and just plain slow compared with other games in this roundup.

You can begin play in one of four modes: Exhibition, All Star, Play-

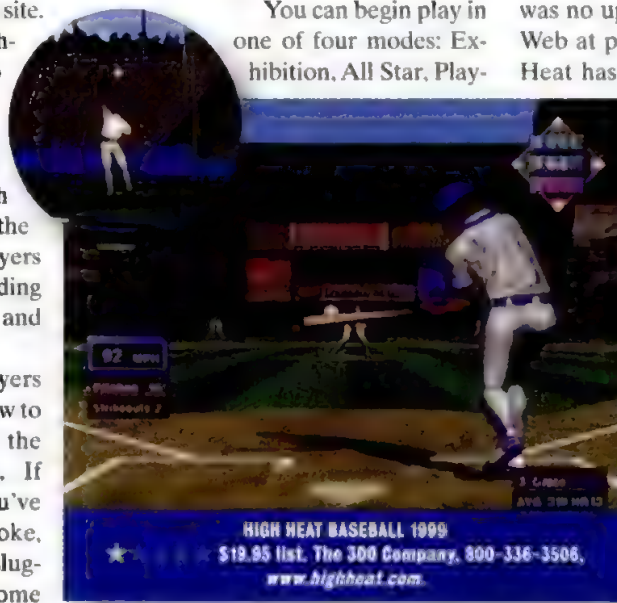
off, or Full Season. There's also a Home Run Challenge in case you feel like hitting a few out of the park. The variable difficulty setting provides a boost to those who haven't yet mastered the game and brings on the heat for those who fancy themselves the next Mark McGwire.

The TruPlay AI guarantees that the players' attributes are taken into account so that the result of each pitch or each at-bat is a probable one. Unfortunately, High Heat's slow 3-D frame rate and unattractive 3-D scenes get in the way of enjoying this hidden intelligence. All of the 30 major-league ballparks are modeled, but the players are not well animated, and the ball travels too slowly. There is no variation in style among players, and the uniforms look nothing like those of major-league teams.

There is a dash of authenticity in the fact that Ted Robinson, the announcer for the San Francisco Giants, is behind the microphone for the play-by-play analysis.

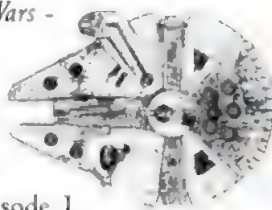
The package comes with the 1998 major-league roster, and you can trade players with other teams. However, there was no updated roster on the Web at press time. And High Heat has no support for network play. The installation procedure does, however, provide a separate path for the 3Dfx Voodoo2 and Riva 128 3-D graphics acceleration cards.

In spite of the vendor's claim of an authentic baseball experience, High Heat Baseball 99 is limited in features, and the game's 3-D





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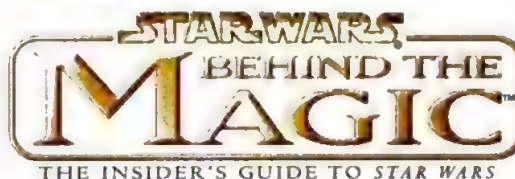
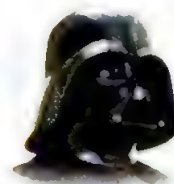
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After Hours

quality and performance are disappointing.—S/JY

Microsoft Baseball 3D

Microsoft, teaming up with developer WizBang Software, has published Microsoft Baseball 3D, the company's first step into the PC baseball game market. A no-frills game, it's fairly standard in comparison to most of the games reviewed here.

Baseball 3D isn't a bad game, especially for a first outing. It just needs a few more features in order to compete with the big boys.

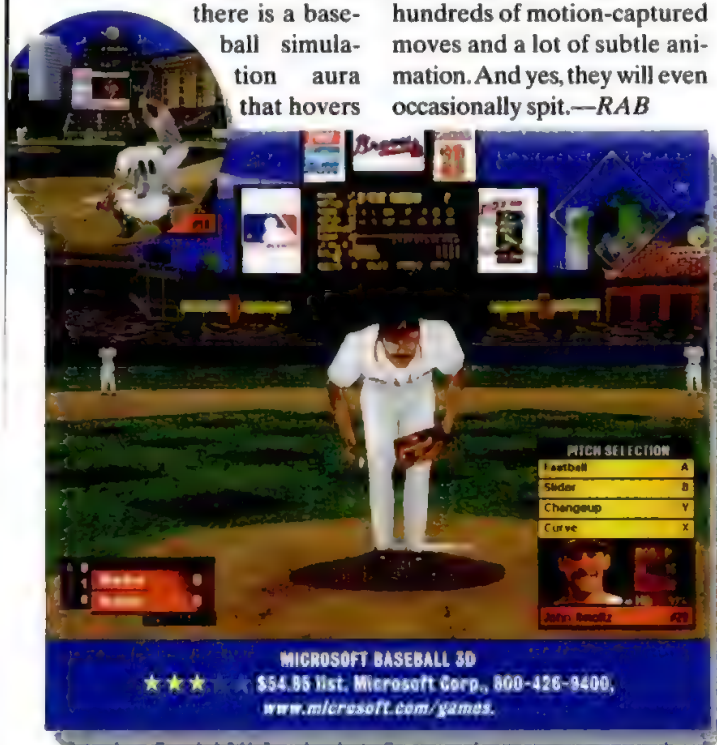
Sure, you can play a single game, a season, or play-offs, but where is the create-a-player option, the home-run contest, and the ability to trade players? It's all the little extras (the things that are found in a game like Triple Play 99) that make a great baseball game so compelling, and it's their absence that holds this one back.

Game play is tight and less oriented toward arcade-style action than in Triple Play 99. The pace is a bit slower, and there is a baseball simulation aura that hovers

over the game. Everything is molded after its real-life counterpart, from the rendered stadiums to the recognizable players' faces. The game includes all the teams and rosters from the 1997 season, meaning you won't be able to play as the expansion Tampa Bay Devil Rays or Arizona Diamondbacks.

The batting and pitching system relies on a cursor inside the batter's box, with which a pitcher must target, and which the batter must also use to hit the ball. This particular system allows for greater accuracy on the batter's side and the use of more strategy on the pitcher's side. For this reason, Baseball 3D is sure to be attractive to those looking for a true-to-life simulation.

The game requires a 3-D video accelerator card with 2MB of RAM (4MB recommended), and we suggest that you adhere to the manufacturer's recommendations. In deference to its title, Baseball 3D has beautifully rendered graphics, and the players have hundreds of motion-captured moves and a lot of subtle animation. And yes, they will even occasionally spit.—RAB



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After Hours

Headed for "the Hall"

Casual fans, beware: Baseball Mogul 99 (\$30 street; Infinite Monkey Systems Inc., 800-229-2714) is a franchise simulator for the serious baseball fan. You won't find any balls to hit or any diving saves to make. What you will find, though, is ticket prices that need adjustment, broadcasting contracts, and anything else that needs to be addressed in order to have a successful team.

Essentially, you play three roles in this game: owner, general manager, and field manager. As an owner you must keep track of and allocate finances to keep your big boat afloat. As general manager you craft complex trades and handle veterans and prospective rookies. Finally, as field manager you've got to determine your batting order, monitor pitching rotation, and constantly observe statistics.

Baseball Mogul is all about numbers, but the goal is to create a financially and professionally successful team. You are rated and compared with the great managers such as Casey Stengel by a point system based on your win/loss record and play-off

appearances. You can play as long as you want—preferably over ten seasons to get a proper rating.

The interface is point-and-click, and in terms of game layout you are dealing with a lot of charts and figures. The scope of the game

play is determined by you and can be run on a day-to-day or season-to-season basis. There is enough detail in Baseball Mogul to let you drill down to the minutiae of the game if you wish—or you can choose to deal with the game on a broader scale. We bet, though, that you'll feel compelled to immerse yourself fully in both ways.

It's highly addictive, but how realistic is it? As

Boston Red Sox team owners over a 12-year span, we were knocked out of the play-offs a few times and lost a World Series. Even the Curse of the Bambino exists in Baseball Mogul 99.

—Roderick A. Beltran



Baseball Mogul May 4, 1999

Game Year: 1999 Paper: Budget Year: 1999 Type: Mog

The Mogul Scoreboard

	Attendance	Revenue	Payroll	Revenue	Cash
Angels	54,007	\$11.00M	\$12.10M	\$11.00M	\$0.00M
Blue Jays	26,776	\$7.00M	\$5.71M	\$7.00M	\$2.70M
Brewers	38,876	\$7.00M	\$6.80M	\$7.00M	\$0.00M
Chicago	35,325	\$10.00M	\$4.70M	\$10.00M	\$2.17M
Cleveland	38,000	\$7.00M	\$7.30M	\$7.00M	\$4.00M
Devil	28,887	\$15.00M	\$14.50M	\$15.00M	\$2.00M
Florida	13,887	\$12.00M	\$12.70M	\$12.00M	\$2.00M
Minnesota	26,547	\$13.50M	\$10.50M	\$13.50M	\$16.40M
New York	38,333	\$14.00M	\$14.50M	\$14.00M	\$16.00M
Oakland	21,493	\$8.00M	\$15.50M	\$8.00M	\$0.00M
Seattle	34,000	\$10.00M	\$10.00M	\$10.00M	\$2.00M
Tampa Bay	21,635	\$12.00M	\$15.00M	\$12.00M	\$2.00M
Texas	38,831	\$15.00M	\$17.00M	\$15.00M	\$0.00M
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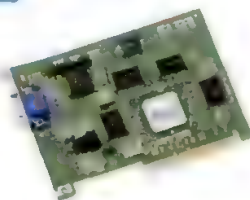
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After Hours

Triple Play 99



Hands down, Triple Play 99 is once again the best baseball software in this roundup. By improving on the previous version and adding more features, Electronic Arts has made this title the one to beat in the competitive PC baseball market.

Additions include a home-run derby mode, which allows tournament-style play and PC network play (via LAN, TCP/IP, IPX, modem, or the Internet). There's also a new bull pen feature that takes into account the amount of time you need to warm up a pitcher. If you keep your fireman in the pen too long, he'll actually start to tire.

As always, you can build your team through the draft

and trades, and the 1998 team schedules and rosters can be updated at the EA Sports Web site. You can also choose to play one game or a full 162-game schedule, or follow your team through several seasons. More than 1,300 stats are kept for each player, so you can keep track of everything from home runs to steals and on-base percentages.

Graphically, this game is in a league all its own. The biomechanics of real players' swings and movements—down to Hideo Nomo's signature contorted delivery style—are

well represented. (All Triple Play needs now is the spitting.) In addition, 29 of the 30 professional sta-

oriented, making games fast and action-packed.

Technology aside, a big highlight this year is the return of announcers Buck Martinez and Jim Hughson. They're funnier and more spontaneous than ever, asking trivia questions and reciting quirky commercials if there is a lull in the action.

On the downside, however, base running is occasionally glitchy, which can be very frustrating. Though not exactly a purist's game, Triple

Play is as close as you can get without picking up a bat and heading to the ballpark. —RAB



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Web Graphics Packages

Designers are getting their own graphics tools for editing and optimizing images for the Web. In our first comprehensive look at this emerging category, we'll review 11 standalone programs and Adobe Photoshop-compatible plug-ins.

3-D Modeling and Animation

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Proxy Servers

Gateways to the Internet, proxy servers let you share an Internet connection, cache Web pages for increased performance, and filter Web content. By exposing only a single machine to the Web, proxy servers also improve security. We'll look at five proxy servers to help you choose which is best.



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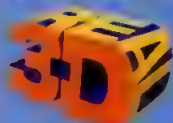
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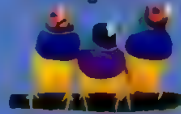
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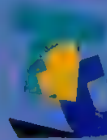
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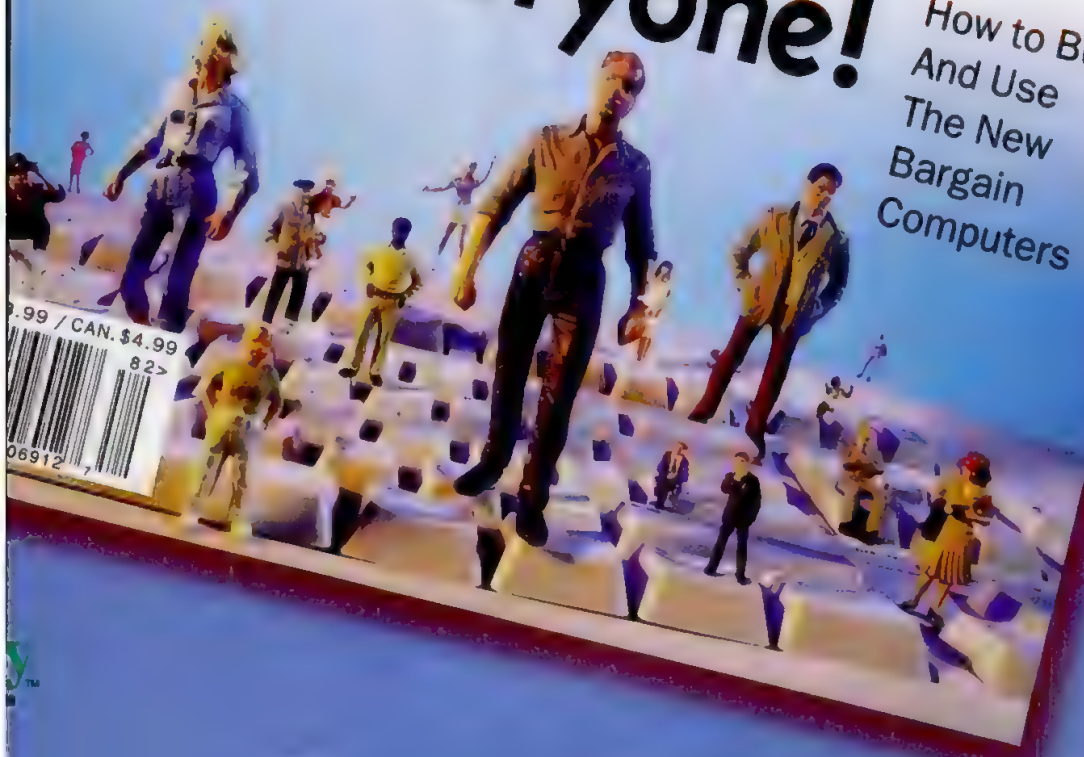
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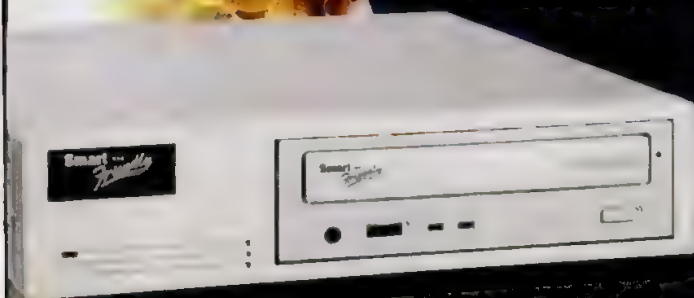
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The AMD-K6-2[®] With 3DNow![™] Outperforms The Intel Pentium II

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The AMD-K6-2 With 3DNow! Is The Smart Choice In PC Value And Performance!**

Just Released: The AMD-K6-2/350 system with 3DNow! is the latest addition to our award-winning, best selling series—the Tiger K-Series! It seems just a few months ago that the standard speed was 200MHz—now we're at 350MHz—WOW! This speed burner does not disappoint either. Just look at the scores that it received, they blow away the Pentium II processor. Of course, Tiger packs the K6-2/350 with all the best components. It all starts with the awesome Super Socket 7 motherboard. It features Ultra DMA/33 support—which blasts data at the unbelievable rate of 33MB/sec., AGP port, three 168-pin DIMM slots that support EDO, SDRAM and PC100 SDRAM, and the big news—the reason this system will blow away the competition—the all new 100MHz bus technology. Then, we place great components into the system like—128MB PC100 SDRAM—the fastest memory available, 10.2GB Ultra DMA hard drive—plenty of space for all your programs and the STB Velocity 128 AGP 3D video with 8MB of memory! This card is outrageously fast—in fact, this one advance in technology—AGP—delivers the ability for these systems to blast through today's most demanding applications. All together, the 3D Now! technology, new bus speed and AGP video combine to create the industry's best performance for your dollar. Smart customers, like you, will realize that these important innovations are driving a new generation of overall performance at unheard of prices. It's the perfect system for the office, home or dorm!

Presenting Our BEST-SELLING Systems!

The K6-2 beats the Pentium II in price and performance, taking personal computing to a new level of performance and realism. With its new, innovative 3DNow![™] technology, the AMD-K6-2 processor offers better overall performance and a superior 3D experience for Windows computing. The world's first x86 processor with 3D enhancement technology, the AMD-K6-2 delivers

sharper and more lifelike 3D imaging, big screen sound and video, and the ultimate Internet experience. The bottom line: the AMD-K6-2 provides the best overall performance! The AMD-K6-2 processor works hand-in-hand with today's leading 3D graphics accelerators to maximize 3D processing power for the utmost realism in personal computing. It's amazing 3D graphics, video, audio and telephony capabilities are unsurpassed. At Tiger Labs, the video and 3D graphics scores were the best we have ever seen. We could not believe it, the AMD-K6-2 beat the Pentium II. To top it off, we've put together an awesome combination of exactly the right hardware to make these systems fly with more power-packed performance than ever before. But the most surprising thing is the low price! Tiger's complete K6-2/333 with 3DNow![™] multimedia systems feature everything you could possibly want in a business system or super gaming system—a whopping 96 MBs of high speed PC100 SDRAM memory, quality 56K Internet-ready fax-modem with speakerphone and voice, huge 8.4GB Ultra DMA/33 hard drive, STB Velocity128-bit 8MB AGP photorealistic full-color video with 3D processing, a thundering 3D wave table sound system and much more.

Faster than the Pentium III! The AMD K6-2 3DNow![™] starts with Tiger's incredible Super Socket 7 motherboard.

It's loaded with features like AGP video port—it transfers data at an astonishing 528MB/second, that's 10 times faster than PCI, Ultra DMA/33 controller onboard, Ultra DMA hard drives are twice as fast as the old EIDE standard, and the motherboard bus speed runs up to 100MHz—it has a 35% boost in performance over 66MHz bus systems. A faster bus speed makes your memory, expansion slots, CPU and more go faster. But, as we mentioned earlier, the biggest difference is in the AGP slot, the new bus speeds push AGP's 528MB/sec. x2 mode to its limits. Only the AMD-K6-2 combines advanced six-issue RISC86 instruction decoders, large on-chip L1 cache, 3DNow![™] technology and AGP graphics to give you leading-edge sixth generation performance!

Another "Premium-Component" System From Tiger!

The All-New AMD-K6-2 With 3DNow! Technology

"The AMD-K6-2 is a miraculous chip, not only because it incorporates a new design technology and in many ways modernizes the way chips will be designed in the future, but because it creates a beneficial processor alternative at the leading edge. AMD is leading the way in developing and producing an important enhancement to the x86 architecture..."

John C. Dvorak, PC Magazine



Better 3D than the Pentium III! The AMD-K6-2 3DNow![™] processor delivers the most powerful solution for 3D multimedia experience compared to the Pentium II processor. It utilizes AMD's instruction set, Microsoft DirectX 6, OpenGL API libraries, and leading game developers to provide the ultimate gaming experience. The K6-2 processor will accelerate and enhance 3D graphics with full-featured MPEG-2 video and AC-3 (Dolby Digital[™]) sound.

Costs Less Than The Pentium III! The AMD-K6-2 costs less than Intel's Pentium II right from the start, but there's more to a complete multimedia system than just the processor. That's

why AMD built the K6 to fit on a motherboard with a standard Socket 7 processor base... the same type of motherboard used for the Pentium MMX and IBM 6x86MX processor. In other words, these motherboards

3D WinBench98

The K6-2 with 3DNow! enhances your 3D experience!

Pentium II 400	988
AMD-K6-2/333	987
AMD-K6-2/300	956
Pentium II 350	933

are built in high volume with competitively lower prices and more popular features. The Intel Pentium Pro and Pentium II, on the other hand, use their own unique processor socket. So there are fewer built with inherently higher prices. And with competition you get technical advances born out of necessity—like Tiger's high-performance DIMM memory slots. DIMM slots have twice the throughput (64 bits) of SIMMs, giving an overall performance boost. You also get the new VIA MVP 3 chipset—the fastest available in the world today.

The Industry's Most Feature-Packed Motherboards!

While the AMD-K6 MMX processor is pulsating with ready-to-run power, the motherboards that we've selected for these state-of-the-art systems add their own dimension of advanced technology. Tiger's technically superior motherboards feature both DIMM and SIMM memory slots, so you can run whatever type of memory suits your needs—from error-correcting ECC RAM (the best for servers), to the fastest SDRAM (the best for power-users). These motherboards also support Ultra DMA/33 hard drives—bursting hard disk transfers up to 33MB/sec! New Ultra DMA/33 mode is twice as fast as the previous best. You also get wave table sound and support of Microsoft's PC'97 specs. The AMD-K6-300 MHz with MMX technology comes with Tiger's marvelous AT motherboard with 512KB of cache, 4PCI, 3ISA and much more. We've included a huge 4.3GB Ultra DMA/33 hard drive. Ultra DMA hard

drive are twice as fast as the old EIDE 16MB/sec transfer rate. With the 24X CD-ROM, you'll never have to wait for a game to load or skip a frame on your favorite CD-ROM movie.

Superb, Heart-Stopping Sound!

Wave Table 3D sound onboard and Amplified Speakers delivers phenomenal music and earth shaking 3D game audio. We've even included a 64-bit video processor on the board with 4MB of memory and 56K fax-modem. OUR BEST VALUE computers—with lower prices and premium components! Use your American Express card and pay in 3 easy payments! Why spend more?...

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"The Tiger K6 was this roundup's leading performer...its MMX numbers were unmatched." —PC Magazine



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- ATX Motherboard
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- Yamaha 128-Voice WaveTable Sound
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- ATX Motherboard
- 56K Faxmodem w/Voice Speakerphone
- Yamaha 128-Voice WaveTable Sound
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- 32X CD-ROM Drive
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- ATX Motherboard
- 56K Faxmodem w/Voice Speakerphone
- Yamaha 128-Voice WaveTable Sound
- Amplified Stereo Speakers
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What the cyber-savvy baby is wearing these days. Down Mexico way, Unix is more than an operating system, it's a diaper!



Bargain-Basement Modems Smell Musty

We were a little surprised at this Q&A in ActionTec's online FAQ:

Q: Is my modem upgradable, say, from a 28.8 to a 33.6 or a 33.6 to a 56K modem?

A: ActionTec is "The Leading Value in Data Communications." Therefore, we have no upgrade policy to 56K at this time.

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Innovative Network Products' LAN-in-a-Bag is great except for one important detail: it comes in a bucket.

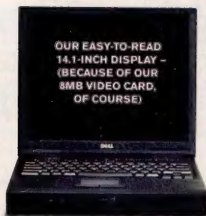
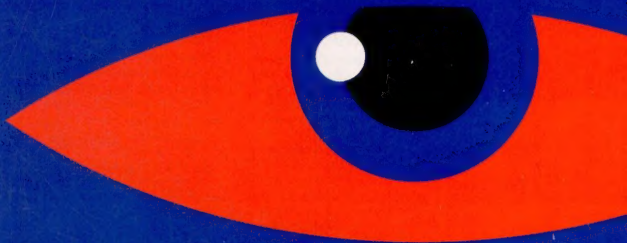
ARF on the Road: Kayenta, Arizona. And in case you're wondering, that URL leads somewhere you don't want to go.



If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802 or via e-mail (text items only) to don_willmott@zd.com. Winners this issue: Claude Bauer, Salvador Garcia, Jon Schwendig, and Debra Wright.

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